AMERICAN MACHINIST

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Universal Radial Drill.

We present with this an engraving representing the universal radial drill, made by the Universal Radial Drill Company, Cincinnati, Ohio, this company making a specialty of its manufacture. This machine, as implied by its name, is designed for drilling holes in any direction and from any point within its compass, the arm swinging entirely around the column, so that work to be drilled may be placed either on the table or on the floor anywhere within reach of the arm.

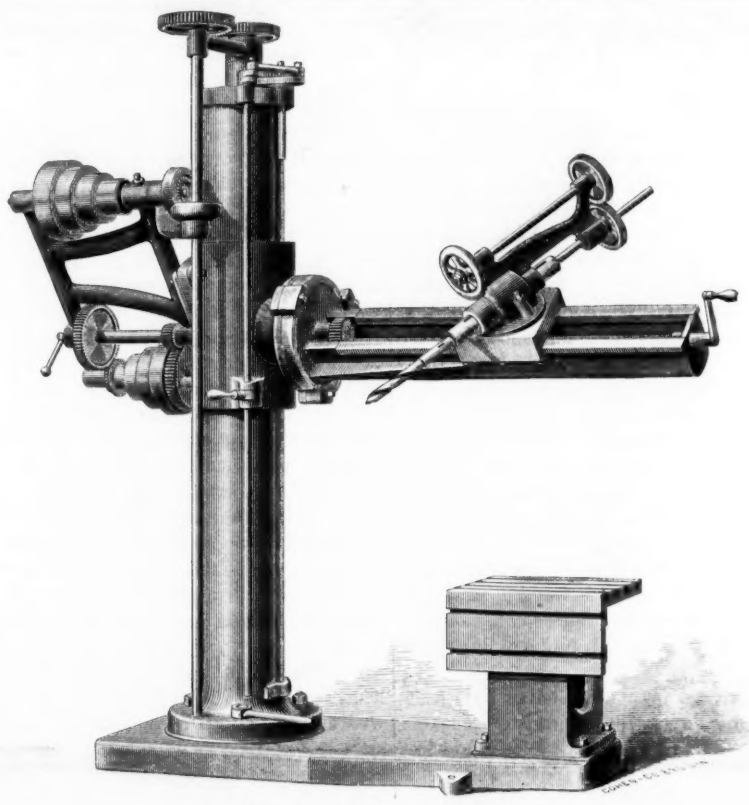
The motion is transmitted from the countershaft to the vertical shaft by means of miter wheels, the vertical shaft being splined its entire length to accommodate vertical adjustment. This shaft drives the large central spur-wheel shown at the top of the engraving, which in turn communicates motion to a second vertical splined shaft that drives the back gear countershaft through miter wheels. All the gearing exposed to accident is hooded for protection. The motion from countershaft to spindle is by means of simple gearing.

To raise or lower the arm, it is only necessary to loosen two screws, and turn the handle shown to the right or left, which puts in operation the proper mechanism for its accomplishment.

The arm is indexed and swivels on the sleeve, and the traveling saddle is also indexed, which provides for rapid and accurate adjustment.

The back gears and four-change cone pulleys provide a sufficient variety of speed.

The gearing is all cut from solid metal, the small gears, as well as the feed screw and spindle, being of steel. The machines are made either with or without power feed.



UNIVERSAL RADIAL DRILL.

Sixteen-Inch Monitor Lathe.

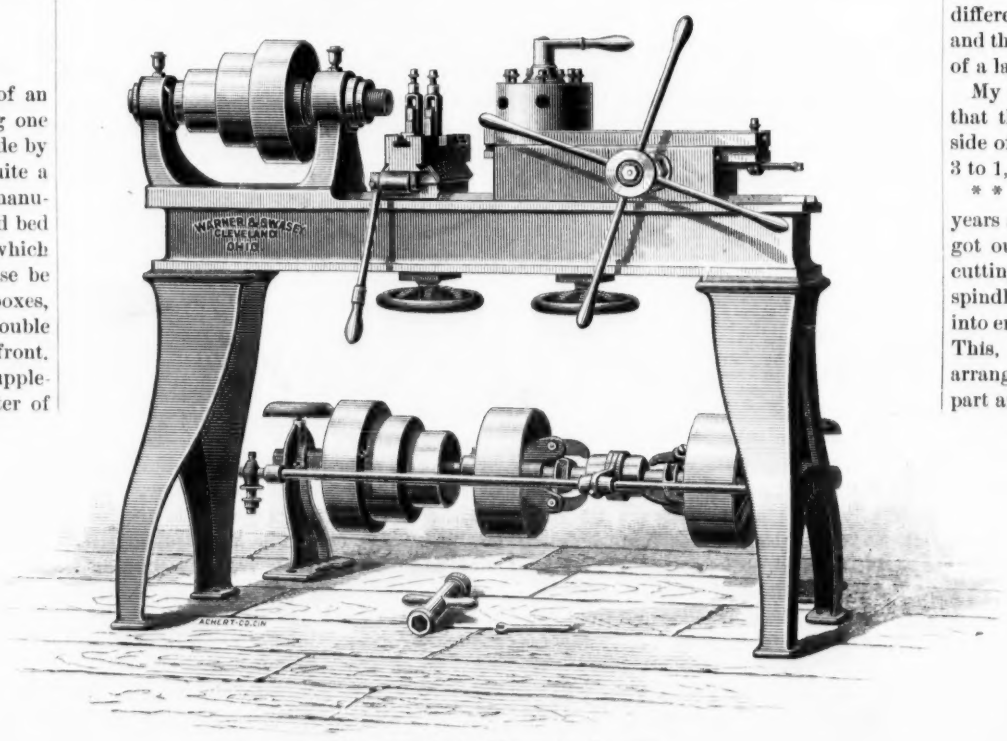
On this page is shown an engraving of an improved 16-inch Monitor lathe, being one of several sizes of such machines made by Warner & Swasey, of Cleveland, O., quite a number of which are in operation in manufactories of brass work. The head and bed are cast in one piece, a construction which gives a rigidity that could not otherwise be obtained. The spindle runs in bronze boxes, and the large bearing has an improved double taper with a hardened conical collar in front.

The carriage is provided with a supplementary taper slide, by which the center of the tool in the turret can be adjusted to the exact height of the center of the spindle.

The turret slide is kept true and in line by taper gibs on each side, running the entire length of the carriage, thereby doing away with thin gibs and gib screws.

The turret revolves automatically on a taper bearing, held by a perpendicular spindle which is fastened rigidly to the slide. To the upper end of this spindle is screwed the binder handle, by which the turret can be securely clamped when taking heavy cuts.

The index is a hardened steel ring, nearly the diameter of the turret. Its square lock bolt has a long, taper gib, adjusted from the back end of the slide.



SIXTEEN INCH MONITOR LATHE.

The cut-off has an improved link motion for working the slide, the height of the tools being adjusted by two wedge-shaped blocks, giving a parallel and rigid adjustment.

A great variety of special chucks and tools accompany the machine.

For making globe valves, the body is held in a chuck having revolving jaws, so that each face to be worked can in turn be brought toward the tools, and the whole piece finished without removing from the chuck, the tools in the turret being placed in their proper order to do the work.

Valve spindles are taken from the rough castings and finished without stopping the machine.

In the shops of the Westinghouse Machine Company, at Pittsburgh, Pa., solid babbitt boxes are fitted by forcing a steel mandrel through them under high pressure, the boxes having previously been babbitted on a mandrel smaller than the one to which they are fitted under pressure. This secures a smooth surface without boring, and expands the babbitt so as to fill the shell without shaking.

Extracts from Chordal's Letters.

CONSERVATISM IN THE MACHINE TRADE—COMMERCIAL VALUE OF CERTAIN MACHINE TOOL IMPROVEMENTS—CHORDAL DESIGNS A CROSS FEED—HOW AN OLD FOGY LATHESMAN TURNED A SHAFT—DOING WORK IN AN EMERGENCY WITHOUT REQUISITE MACHINERY—HOW PLANERS ARE ABUSED—A PLANER ON THE ANTI-AUTOMATIC PLAN.

Mr. Editor:

* * * There have been lots of letters in the AMERICAN MACHINIST lately regarding improvements in machine tools. To read these letters one would think that all that was necessary was to build the most improved form of tool and sell it. I think the man who has undertaken the construction of lathes, etc, embodying all conceivable conveniences and refinements, has found them about as unsalable and unprofitable as any machines could be. The fact is, Mr. Editor, that the machine trade is and has been, and I believe always will be, behind the age. If there is any line of machinery which it does not pay to improve it is the line of machine tools. In thus speaking of improvement I do not refer to every improvement of a tool, but rather to those refinements which give to the machine a new or more enlarged function.

* * * When in the construction of a lathe a certain thing is undertaken, that thing can be properly and thoroughly done without the tool being entitled to the term "improved." Thus, power of belt, stiffness of journals and strength of parts generally, would come under the head of correctness of construction rather than improvements.

One would suppose that some simple device by which all you had to do was to pull a knob in order to set a lathe for cutting different threads would be a tip-top thing, and that when once introduced no other kind of a lathe would sell.

My experience with machine tool buyers is that the common style of lathes put along side of such an arrangement would outsell it 3 to 1, possibly 10 to 1.

* * * I am under the impression that some years ago Ferris & Miles, of Philadelphia, got out a lathe in which all of the screw-cutting gears were strung on a stud or spindle, and that the idler could be swung into engagement with any one of these gears. This, it will be seen, was a very simple arrangement and made the change gear a part and parcel of the lathe, and the change from one thread to another was but an instant's work. I don't think they now make this lathe, although I may be mistaken. It looks entirely too handy and convenient and necessary to be salable.

* * * The fact is, machine tool buyers are an unappreciative class. If you will send a lathesman to buy a lathe he will hunt the earth over for a lathe combining all the facilities which every day he has felt the need of, and he won't find the lathe, because there is not enough of him to make a market for such a lathe. I suppose that every lathesman who ever thinks about lathes at all (and there are plenty who do not) makes up his mind that when his ship comes in and he becomes a lathe buyer he will have something extra

super. When his ship does come in he buys suddenly, for he is short of funds, or he buys old stuff, or something of that kind, and so, of course, has to buy about what other people do Having become a lathe buyer he ceases to be a lathesman, and after awhile he forgets all about lathes and only looks at them as machines to get out work with. He forgets all about his good resolutions, and the machine-tool builders will find him the hardest possible subject to deal with.

* * * Ten or twelve years ago a price list would quote four different kinds of the same lathes. Thus, a price would be quoted for a lathe; next the same with screw cutting arrangement; next the same with cross-feed; next the same with compound rest, and many lathes were sold which were simply "the lathe." It will readily be seen that small lathes, sold through machinery dealers, were made a very difficult article to handle by this peculiarity in the price list. A maker would need four lathes on hand to be able to fill the first chance order. In a very few years, however, for convenience in manufacturing more than anything else, all lathes were made screw-cutting, and I do not think there is now a maker in the United States who catalogues his lathes as "screw-cutting," and "not screw-cutting." The consequence is that a lathe means a screw-cutting lathe.

Cross-feeds made another hitch in the matter. Ten or twelve years ago if you wanted a cross-feed lathe you had to order it built. Very few of them were sold. I believe some makers did contrive a lathe in which the cross-feed was simply an attachment which could be put on or left off according as the bargain dictated. The mere fact of making a cross-feed in the form of a detachable arrangement made the cross-feed cost more than it should. Finally builders got to putting cross-feeds into the lathes without saying anything about it, and that is the way it stands to-day. The buyer gets a cross-feed lathe without knowing and so has no chance to grumble

Compound rests, elevating rests and fancy tool posts stand in about the same position; the builder must either put them on all his lathes or he must leave them off all his lathes. If he puts them on a lathe he gets no money and so loses their extra cost. If he leaves them off his reputation is not hurt.

* * * When I was a cub I had a terrible struggle with my boss trying to get permission to rig up cross-feed for a lathe I was running. It was a New Haven lathe, 30" swing, about a 20-foot bed, I should judge. I had schemed out some marvelous plan, with rods, and cam, and ratchets, which would give me the proper motion. I made the patterns and stole the castings and forgings and time, and finished the thing up on the sly and hid it. I then commenced my pleading. I was told that a lathe did not need any cross-feed. I studied on this matter about a week and got a re-hearing. I was then told that if I had time to build cross-feeds I had time to do the cross feeding on that lathe. On further petition I was told that it must not be put on the lathe; that such things were nonsense. It never did go on either, and only a short time ago I looked inside my old tool-box and found pieces of that cross-feed rig.

* * * At first thought it does seem hard to bring any argument to bear in favor of a cross-feed. In fact, the only argument I know of is the general one that a machine-fed tool will do more and better cutting than a hand fed tool. This applies to every form of tool that cuts iron.

* * * I once hired an Englishman, a gray-haired man just over, who said he was an experienced lathesman. I gave him a 30" lathe of tip-top construction, and was amused at the changes in his face. After some dubious matterings, he said he never ran a slide lathe He had been used to old-style shoulder tools, and explained that he could turn a 24" drum (by which he meant pulley) as quick as anybody. I told him that if he could do that kind of work by hand, he was as good a man as I wanted to run that lathe, and that I would risk him. I was mistaken, however, for he was the worst case of a lathe hand I ever saw. I even had to explain the motions of the lathe to him, and instruct him in the shape of tools, and I took him samples from the other lathes.

The first job was a 3" shaft to be turned up and have couplings fitted. He got the shaft centered and straightened in a masterly manner, proving that he had had much experience with lathes. He put a cat-head on it and set the steady rest in a jiffy. I squared the ends of the shaft myself, and set a tool and started a cut. It was then all right, and all he had to do was to watch it. But he took hold of the crank that moved the carriage, and until the carriage got up near the steady-rest he never let go of it for a blessed minute. I could not laugh him out of this thing at all.

The next cut was, of course, to bring the shaft to size, and it was fun to see him start the tool. He commenced up about 2", and kept hogging away little by little until he got a little place that would caliper right, and then fussed with the tool until he got it so that it would turn that size. When I came around again I found that he had turned down the shouldered fit on the end entirely by means of a hand tool which he had managed to pick up somewhere, and that he had also taken the big spots off of the shaft by the same plan. He explained to me that he was afraid to risk the machine on the accuracy required for the coupling fits.

He also explained another thing, which, I guess, was a novelty to both of us. Said he: "In turning by hand, the end of a job gets rounded down a trifle smaller than the balance, tending to a rounded point, as it were; but I notice that this machine tends to leave a big place on the end of a shaft." I guess that was true, but it came out of his ugly way of working the tool inward as it fed along. It was evident that he could not engineer this lathe, and I found a little bolt lathe for him.

The job I gave him consisted of forty half-inch bolts for the cylinder heads of portable engines. We were short of hands, and I left him to his own devices, partly because I knew he was bound to accomplish something, and partly because I wanted to see how he was going to do the thing. He deliberately set to work and made two or three hand tools and a chaser. He speeded that lathe up, and did that job as well and as quickly as it could have been done by better means.

* * * In admiring this old fellow's handiwork, I do not mean to be taken as commending fogy processes. Like other mechanics, I am curious about difficult performances.

Some time ago I wrote you regarding a native Indian method of producing long square-threaded screws of considerable pitch. Those Indians did it that way because they knew no better. A man who knows the better way of doing it is seldom capable of accomplishing it in the absence of certain machinery requisite for that way of doing it. This is the main reason for my thinking that a mechanic is the better for not learning his trade in a well-fitted shop. I can now tell you of a mechanic who knew how to run a screw-cutting lathe, and at the same time was capable of doing the work without the lathe.

In 1879 the United States ship Enterprise was sent on an important surveying expedition on the Amazon River. At a critical season of the year the lower connecting-rod bolts broke and let the rods come dangling down in the well, to be hammered by the crank each time the shaft turned, the engine being double. The connecting-rod was badly bent, but was straightened in a brick furnace built on deck. The bolts which broke were 3" in diameter, and the case looked hopeless. Finally it was found that the supporting axle of a large pivot gun was just the right size and long enough to make the bolts. Four bolts were accordingly cut from it, and James Moore, one of the ship's machinists, filed good threads on each end of the bolts by hand.

* * * In the matter of lathes, there is getting to be quite a respectable demand for machines that will take a respectable cut. Not every purchaser, however, cares very much about it. It is simply astonishing how much bother and annoyance and inconvenience and loss of time and money a machine-shop owner can put up with on account of light-built lathes, and then it is amazing to see him purchase another just like the weak one, and probably go to a great deal of trouble to find one just like it.

Planers seem to be expected to carry a cut in proportion to their size, and if they will do that, and will keep doing it, little complaint is made, and there is little inducement for manufacturers to change the order of things. In drill presses a man will buy about whatever comes along, if the price happens to suit him.

* * * Speaking of planers, I am reminded of the fact that, in small shops, the planer is a tool having about one day's work in a week, and the job is given to whoever happens to be idle. The consequence is that the planer is everybody's tool, or nobody's, which is the same thing. It never gets oiled, as long as it will run, and a man will shift it by hand for an hour's job, rather than spend an hour doctoring the shifting motion. Maybe the apron will come up on the back stroke, and maybe it won't. Maybe it will come down at the end of the stroke, and maybe it won't. And if it does come down, it don't seem to care much just where it stops; but a lick with the chipping hammer each stroke will remedy this fault.

The planer had a down-feed on it, but it got gummed up and out of kilter, and has not been used for four years.

There is a certain chunk of iron somewhere around the shop which will balance the shifting lever so that it will work tip-top, if the chunk can only be found. The table was planed off true once, but now it is considerably scarred up, and all manner of things are kept piled upon it when not in use. The dogs will not slide the whole length of the table. There are two spots where the dog must be removed and carried over the obstructions bodily. The feed is very indifferent about how it does its work. It probably needs a new leather in it, or ten minutes' adjustment. Probably no one in the shop knows there is any leather in it, or that it is capable of adjustment. It is called N. G., and let off with that.

The last man that used the planer, for some reason known to himself, was particular that the rail should be level with the table. The screws would not bring it so, so the easiest way out of it was to let it down on a pair of parallel strips and then bolt it fast. The next man who tackles the machine will find the screws entirely disconnected from the rail.

The belt for this planer is the sorest spot about the shop. The man who fixes it has only a momentary interest in it, so he only half fixes it. The consequence is that every man who touches this planer must fix the belt, and every man in the shop knows it and gives the planer a wide berth if he can possibly do the job in a vise. A chuck purchased with such a planer will get kicked around the shop generally, and will be tee-totally wrecked within two years.

* * * The question of where to put the lifting crank on a planer has lately been discussed in your columns. The first planer I ever had anything to do with had this crank on the front side of the machine, and I soon found that there was only one proper place for it, and that was on the backside of the machine. The operation of adjusting the rail is as follows: The workman is naturally on the front side of the machine. He loosens the rail bolts on that side. He carries his wrench around with him and loosens the bolts on the rear side, raises his rail, or lowers it, as the case may be, tightens the back bolts and goes around in front again and tightens those bolts. If the crank is on the front side of the machine, it is bound to make one extra trip around the planer. There might be two cranks, of course, but there is no earthly use for the one on the front side.

I have noticed one thing about this rail-lifting operation in connection with planers which feed by means of a rod running up to the rail and held by a set screw in some sort of a rocker-arm. The man will invariably forget this screw, until in raising the rail he brings everything up standing. Then he will have to tear things to pieces in order to get at things to straighten them. This rod business, I believe, is getting somewhat scarce nowadays as a planer feed.

* * * Speaking of planers and of my old boss reminds me of a Detroit planer which I am not really certain I have not told you of before. This planer had no automatic feed motion and no automatic belt shifting motion. It was the man's business to pull something at the end of each stroke, and to turn something whenever he wanted any feeding done. The owner of the shop always insisted that when he paid a man to run a planer he didn't see what the sense was in having so many self-acting traps about it. * * * *

Very respectfully,

CHORDAL.

Vulcan and Orpheus; or, Anvil Versus Fiddle.*

BY OBERLIN SMITH.

CANTO I.

Argument:—In a forge, in Ancient Greece, the master-smith exalteth his anvil and inertia in general, and becometh prophetic—almost inspired. An orchestra man exalteth, in his turn, his cat-born instrument, and twitteth two cities pertaining to ye future Yankee. He waxeth eloquent and threateneth, direly, suggesting his own ghost, which the forge-man squelcheth in prophecy.

In days of old, a blacksmith bold,
Stood in the glare of his forge and told
His friends and henchmen, in conclave called.
Of his mighty anvil, securely walled
In dungeon-like cave, 'neath Etna's base,
Where his Cyclops forged, with grimy face.

He, Vulcan, then told them, with earnest glee,
This anvil a type and a pattern should be,
Throughout all time forward, in metal art,
Of solid construction in every part—
All proof against quiver, and tremble, and thrill;
Its inborn inertia yet holding it still.

With prescience bold, of the future he told—
An age of invention—iron greater than gold;
Of mighty steam engines; of roadways of steel;
Of cog and of lever, of shaft and of wheel;
Of cunning machine-tools, with all but a soul.
"My anvil," cried he, "shall inspirit the whole."

"Not so," said a list'ner, Orpheus the gay,
"My lyre's the true emblem, for work or for play;
Adown through the ages its music shall thrill
In grove and in temple, in mansion and mill;
From Cyprus and Naxos, its pastoral home,
To Fitchburg and Worcester, in ages to come."

"In that future day, both for work and for play,
For your boasted machines, or for minstrelsy's lay,
My lyre shall still tremble, and vibrate and shake,
In wood-work and iron-work of every make.
Its exquisite tremors, e'en if not heard as sound,
Shall in all man's constructions forever abound."

"Very good," said old Vulcan; "Yes, oft in the arts,
For tensional structures, for quick moving parts
Of machines, and for lightness of transport, I own
Dead weight is at discount; Vibration we'll crown.
But for tools to cut iron—slow precision the aim—
Pile on the inertia! My anvil's the game!"

"If you and if I, though we're god-born, shall die,
My ghost"—thus quoth Orpheus—"never shall lie
Quiet in its cerements, but ever shall haunt
The pathways of men—shall take fiddling jaunt
From workshop to workshop, and banish from mind
Your clumsy old anvil and all of its kind"

"If we," said Vulcan, "we, though god-born, die,
My ghost dies too; but mark my prophecy:—
Before the nineteenth century has passed,
As time the Christian tribes shall count, your last
Of ghostly fiddling ends, and Common-sense
Membraneous, shivering tools shall banish hence."

CANTO II.

Argument:—In modern, and more Occidental times, "big things" in machinery are recounted, and inertia again exalted. This canto also intimateth a need of sympathy for ye poor foundryman and in general abuseth ye Orphean ghost, whose power it duly acknowledgeth.

Past are those times: turn must my rhymes
From Isles of Greece to Western climes;
From age of myth and poesy
To modern ingenuity,
Which, marv'lous art and cunning skill
Abounds in every shop and mill.

The products of this modern skill,
Wondrous machines, with all but will,
In each department of the arts,
Daily enacting all their parts,
Are in the best proportion planned,
Each of its kind, by master hand.

*For a previous discussion upon the "anvil principle" *versus* the "fiddle principle" in the design of machine-tools, see an article by the same writer, in the Oct. 7th, 1882, issue of the AMERICAN MACHINIST, entitled: "More Inertia, for Machine Shops."

To plow, to sow, to reap and mow;
To grind the grain; to mix the dough;
To spin the flax; the shuttle throw;
The finished cloth to cut and sew;
The stone to dress; the trees to hew;
The ground to dig, where once they grew.

For mighty railways; steeds to breed
Of brass and steel, for every need
Of rapid transport; words to send
On lightning's wing to absent friend;
To light; to warm; and e'en to kill;
Obedient to each guiding will.

These cunning tools approximate
All, more or less, a perfect state
Of tension, weight and proper strength
In every member—each in length,
And breadth, and height, proportioned well
Save one grand class, which, shame to tell,

Is starved and lean, by stinting mean,
In cheap cast-iron—the makers keen
To save in weight. This class of tools—
Machine-tools named—should, by all rules
Of common-sense, most massive be;
Inertia-bound 'gainst trembling free.

These tools in weight few limits need;
Their members have not rapid speed,
To tempt momentum's baleful jerk;
Neither does self-destruction lurk,
Inherent, with excess of weight,
Like ship, or bridge, miscalculate.

In running cost no money's lost,
As in a car or steamship tossed,
By adding weight beyond the need
Of actual strength. The only heed
Is first expense, which trifling is
Compared with all advantages.

In Europe this they understand,
In some degree. In Yankee land
A cunning skill would bring to nil
Each extra ounce in foundry bill;
Rare talent's pitted versus weight,
A starveling brood to incubate.

Yes, Orpheus' ghost inspires this host
Of mad designers still. The most
He can does he to make them make
Machines whose function 't is to shake—
To twist and wriggle under strains,
As though they suffered mortal pains.

CANTO III.

Argument:—This canto encourageth ye reader, praiseth much pig iron, prophesyeth redemption for ye wicked cities, and completely smasheth ye ghost.

The century draws toward its close,
The curse of Orpheus to oppose
There dawns the era long foretold
By Vulcan, in the days of old.
The work's begun; each maker tries
More weight to gain—with rival vies.

Few years shall pass ere weight and mass,
Pure dignity of iron and brass,
Shall recognized hold their place—
The *anvil-idea* be the base
In planning tools to turn, or drill—
To plane, or slot, or grind, or mill.

Old Vulcan shall triumphant be;
His schemes of grave solidity
Fitchburg and Worcester shall redeem;
Each pig-iron seller's eyes shall beam;
And Orphean *fiddle-strung* machines
Shall be remembered but in dreams.

The *Ironmonger* says: "The new tariff of the United States is expected both in Germany and Austria to increase the exports of these countries to America. Austria and Hungary especially hope to be able to export large amounts of iron, steel, leather and glassware. The exports of Austria and Hungary to the United States have increased from $4,000,000 to $9,000,000 in the course of four years. The actual export is probably much greater, because much of it passes through Germany, and is, therefore, not to be separated from the export from Germany."

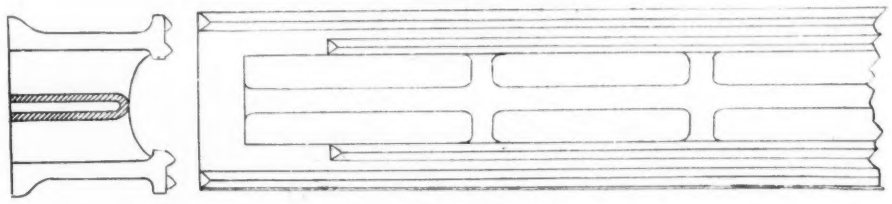
According to the last census the railway employes of the United States comprised one-thirtieth of the male population twenty-one years of age and upwards.

The Financial Chronicle published a tabulated statement of the earnings of about 60 railroads in March, 1882, and March, 1883. It shows a little less than 10 per cent. increase of mileage over last year, and more than 20 per cent. increase in earnings.

Considering the recent activity (mainly in spreading newspaper notices), there is some prospect that not only the Brooklyn Bridge, but the Washington Monument, the Capitol at Albany and the Hudson River Tunnel will be completed within the present century.

New Lathe Bed.

We have previous to this referred to the arrangements of several machine tool builders for strengthening their lathe beds against deflection. The annexed engraving shows a lathe bed devised by Mr. Eberhardt, and which will be used by E. Gould & Eberhardt, Newark, N. J., in their future lathe construction. The engraving clearly shows, without the necessity of explanation, the construction of the central strengthening channel and branches, which it is claimed strengthens the lathe bed 30 per cent., while adding but a trifle to the weight.



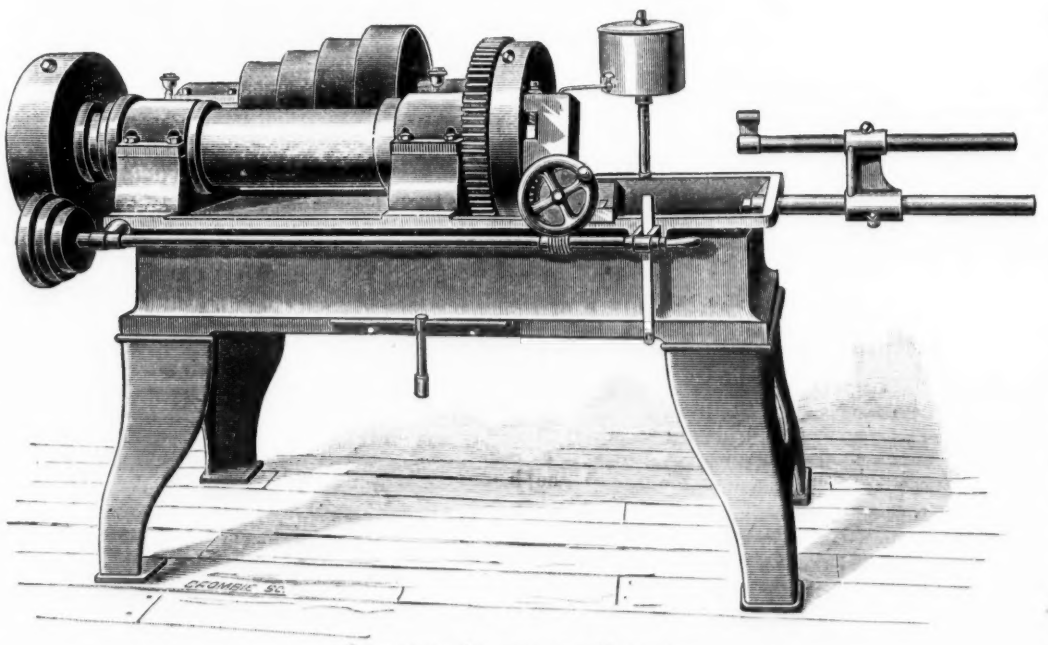
NEW LATHE BED.

Hyde's Improved Cutting-off Machine.

In the AMERICAN MACHINIST of February 18, 1882, we published an illustrated description of Hyde's cutting-off machine, made by Warren Haskell & Co., 36 Charlestown street, Boston, Massachusetts. Since that time a larger and more powerful machine has been built to suit the requirements in cutting up larger quantities of heavy material. The capacity of the former machine was to cut all sizes of iron from 2⅝" downward. The new machine shown in the accompanying engraving, cuts all sizes up to and including 4½" diameter.

The cone upon this machine has four changes of speed for a belt 3½" wide, and has a back gear attached, the large gear forming a part of the chuck.

With the two changes of speed by pulleys upon the countershaft, eight different speeds of the spindle are obtained, varying from 13 to 100 revolutions per minute. The bearings of the main spindle are 6¼" in diameter by 7" long.



IMPROVED CUTTING-OFF MACHINE.

The tool post is constructed similar to that upon the smaller machines, and having two lateral adjusting screws, after adjusting the cutting tool, it can be removed for grinding and replaced in its original position without requiring a second setting. When the bar has been cut through, the feed is disconnected automatically. By an ingeniously-devised clutch upon the countershaft the speed of the spindle can be increased as the cutting-off tool approaches the center. The driving pulleys upon the countershaft are 10" and 12" in diameter, with 4" face, the speed of which should be 100 revolutions per minute for the former and 200 revolutions for the latter. The weight of this machine is 1,700 pounds.

Accidents to Train-Men.

One of the most commendable steps taken by the Master Car-Builders' Association is the appointment of a committee from year to year to investigate and report upon the causes of accidents to train-men, with recommendations as to the best means to be adopted for the prevention of such accidents. The first committee appointed by this association for the above purpose was in 1878. They investigated the primary causes of accidents to train-men, and reported upon the same, recommending the adoption of certain resolutions tending toward the elimination altogether of certain dangers and reducing others, particularly the most flagrant.

Some railroad companies have promptly adopted the recommendations of the committee, thereby lessening the danger of accident to their employés, but others still adhere to their old-time policy of "Go as you please; ours is good enough."

When a train man gets caught between two cars and is killed, many railroad companies, instead of ascertaining the cause of the accident and taking active steps to lessen, or if possible remove such causes altogether, simply put another man in his place. In fact, there is a good deal of truth in the incident related of a man who, upon applying for a situation at the office of a certain railroad superintendent, was told that there were no vacancies at present, but as they were killing quite a number of men, if he would leave his address, notice would be sent when a vacancy occurred.

Human life is often considered of too little consequence. The placing of drawheads of varying heights above the rails is often the cause of serious accidents.

The standard height of drawheads from top of rail to center of opening, as adopted by the Car Builders' Association in 1879, is 33 inches. In some cars built since the adoption of this standard, the drawheads vary from standard as much as three inches. The placing of two blocks at the sides of the drawheads is also a source of great danger, as the distance between these blocks varies from 11½" to 28". Any person of ordinary intelligence can comprehend at once that a man takes his life in his hand, as it were, every time he attempts to couple cars arranged in this manner.

Dead-wood blocks placed at the sides of drawheads ought to be abolished altogether, and a single block, six inches thick, placed immediately above the drawhead, as recommended in the resolutions adopted by the association. When blocks are placed in this way, a man runs very little risk of being squeezed to death by coupling cars.

The drawheads should have large openings in order to permit the coupling links to enter with very little assistance, which might be afforded by means of a stick or any other convenient instrument. The pins should always be made to pull out, as those which are so fastened, to prevent them from being removed from the hole in the drawhead, have been the primary cause of much loss of life or limb.

A man, in missing a coupling, will naturally give a signal to the engineer, then get between the cars to adjust the pin as the cars start. He follows along until his foot is caught in a guard rail or a frog, and before he can extricate himself the train passes over him.

There is often a lack of steps at the ends as well as of handles at the top of cars. We recently knew a very valuable man upon a certain railroad who climbed upon a car in motion, and running up the ladder at the end, reached for the handle supposed to be upon the roof. The handle was gone, and soon was gone also the man, for he fell and the train passed over him.

The running boards upon the tops of cars are in most instances too narrow, being often composed of only a single board ten or twelve inches wide, when they ought to be at least 24."

The placing of brake staffs should also receive more careful attention, as men often lose their hands or fingers between the wheels as the cars come together. More careful observance of these and other small details in the construction and running of cars would tend to reduce that class of train accidents which can and ought to be avoided. The persistent attention which the Car Builders' Association have and are giving this and kindred subjects pertaining to the safe handling of rolling stock deserves the warmest commendation not only of every railroad man, but also of the public at large.

Peter Cooper, but a few days before his death, established another free school at Cooper Union. It is for the instruction of females in "type-writing." The machines are now in position, a competent instructor is provided, and the school open for admissions. Classes will be formed, and about two months will be required for instruction.

Forced vs. Natural Draught.

From inquiries which we from time to time receive on the subject of forced and natural draught in connection with steam boilers, it is evident that there is a good deal of interest as to the relative economy of the two systems; not so much the economy resulting from the generation, by means of forced draught, of an increased quantity of steam in the same boiler, as the relative fuel economy of the two systems. It is well known that more steam may be generated in a boiler by forcing the draught, either by means of a live steam jet, by the use of the exhaust steam for the purpose, or by a fan or other blower, and this increase of capacity, in many instances, noticeably in the locomotive engine, represents economy; but what is not generally well known is the cost, so far as fuel is concerned, of generating steam for industrial purposes by forced draught, as compared with natural draught, the conditions being suited to each case. Any definite information on this subject would be of value,

Shop Kinks.

No. 43.

BY LEWIS F. LYNE.

HANDY SURFACE GRINDING DEVICE.

The engraving represents a very handy and efficient grinding device which can be applied to ordinary shaping machines. It was applied to a shaper by Chas. A. Lieb, of New York City, and has been used with entire satisfaction in his shop for several years. *A* represents the body or frame of the shaper, *B* the ram and *D* the slide for holding the tool-post. *C* is a nut connected with a stud o r pin through the end of the connecting-rod by means of which the travel of the ram may be regulated.

The countershaft for driving the machine should be located directly over the middle point of the stroke, as shown.

An extra pulley *I*, should be placed upon the countershaft for driving the emery wheel.

When it is not convenient to place a pulley upon the counter shaft a separate shaft should be put up, as the cost is small and the advantages to be gained thereby are great.

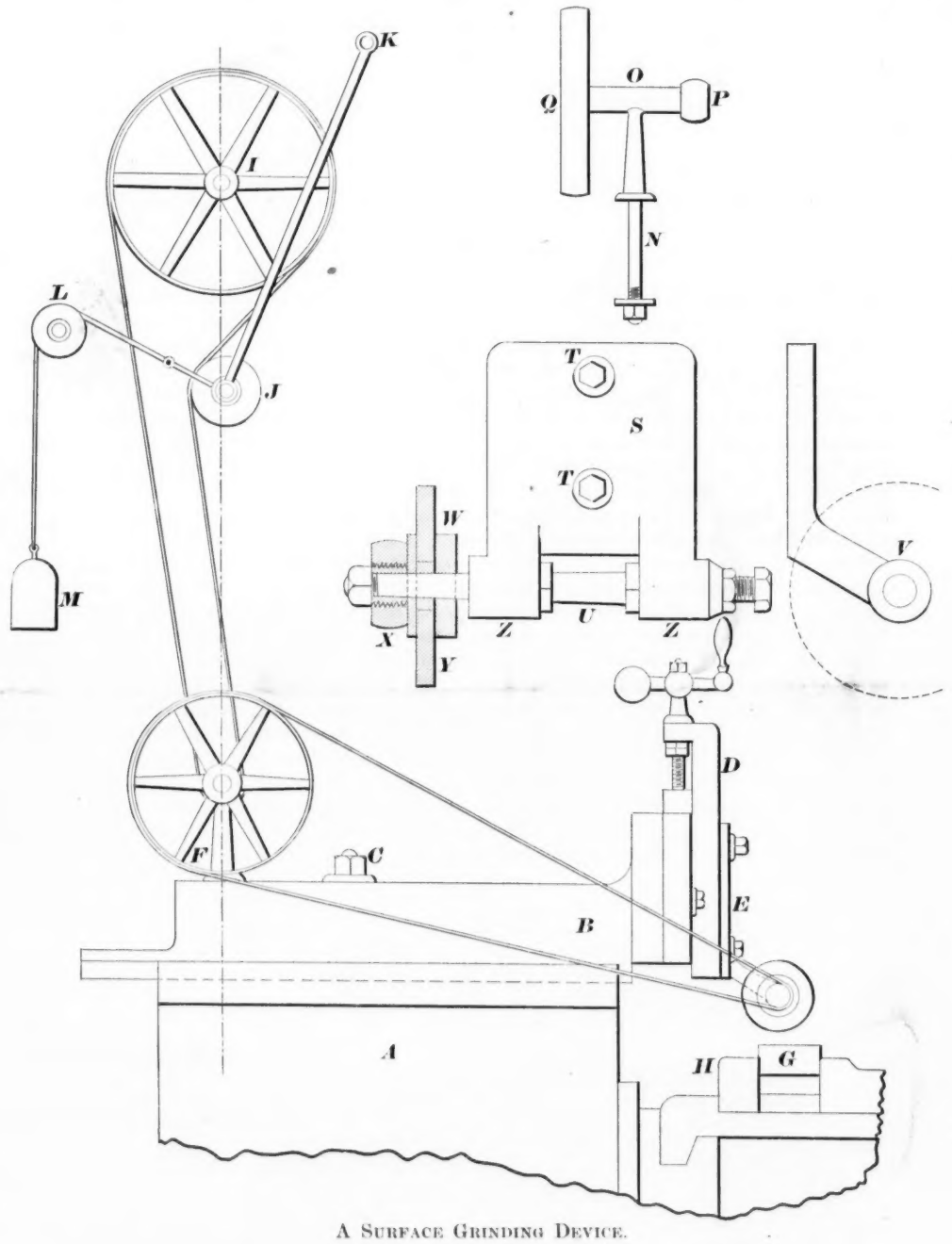
A standard *N*, is made with a journal *O*, at the top to carry a shaft with a pulley upon each end.

The part *N*, passes through the ram, and the nut secures the standard firmly in place, and when once set this standard may be left in position permanently, as shown at *F*.

The grinding device consists simply of an emery-wheel *Y*, attached to a mandrel *U*, running in journals, *Z*, *Z*, *V* forming a part of the plate *S*. The mandrel *U*, is of hardened steel ground with tapered journals in which the lost motion may be taken up by turning the hexagon heads upon the ends of the split boxes. Lateral play is taken up by a set screw and jam-nut at the end.

The emery wheel is held by a steel thimble *W*, having a thread upon it passing through the wheel. The nut also forms the pulley *X*, by which the wheel is driven.

All the wheels used with this device are fitted in this way, and have a tapered hole through the center fitting upon the tapered end of the mandrel, as shown. This taper is ground so that each wheel, when once trued up, is sure to remain so when secured upon the taper by the nut at the end of the mandrel. By placing these thimbles in the wheels, any wheel can be placed upon the mandrel in a few moments with a certainty of its running true, whereas it would entail an endless amount of labor if each one had to be set in the usual way upon the mandrel.



A SURFACE GRINDING DEVICE.

The plate *S*, with the wheel in position, is quickly secured in position upon the ram, as shown at *E*, by slipping off the tool post.

The two tap-bolts, *T*, *T*, secure the plate in position. The driving belt is made to conform to all positions of the pulley *F*, as the ram travels to and fro, by the application of a tightener, *J*. This tightener is suspended from any convenient point *K*. A weight *M* suspended from a cord passing over the pulley *L*, pulls the tightener against the belt with a uniform pressure.

The countershaft, with the pulley *I* upon it, runs at a speed of 175 revolutions per minute. The diameter of this pulley is 15″, from which a belt 1½″ wide runs to the pulley *P*, which is 2½″ in diameter.

The pulley *Q*, is 12″ in diameter, from which a belt ¾″ or 1″ wide (depending upon the diameter and face of the emery wheel to be used) transmits power to the mandrel *U*. When desired, the emery wheel can be made to fit in the middle of the mandrel at *U*, between the boxes, but the way shown is much more convenient.

The work *G*, to be ground is held in the usual way by the jaws *H*, while the emery wheel traverses back and forth over it. When it is not convenient to apply the pulley *F*, the pulley *I*, with its countershaft, can be located directly over the mandrel *U*, using the tightener in the same manner with but one belt. This device can be used by anybody who desires it

Wages in Australia.

According to an article in the *Chicago Times* the condition of the workingmen in Australia is quite comfortable. Work is plenty and wages good.

"House rent, perhaps, is the only item that is extravagant, but a workingman can afford to pay $2.50 or $3, or for three rooms and a kitchen up to $3.50 per week, when even a common laborer gets $1.50 and $1.75 per day, which is the very lowest daily pay.

"The Government day rate for a laborer is $1.85, and lumpers or stevedores' men get $1.75 per day in Sidney and Melbourne. Engineers employed by stevedores to run donkey engines and men at ordinary work on board tug steamers get from $70 to $90 per month. Melbourne ship-carpenters get $3 and $3.25 per day for 8 hours.

"In the iron trades, boiler makers and platers get per day from $2 50 to $3 50, riveters from $2.25 to $2.75, blacksmiths from $2.50 to $3, hammerers from $1.75 to $2, moulders from $2.50 to $3, engineers from $2 to $3, fitters from $2.50 to $3 and turners in iron from $2.50 to $3.

"There is a great deal of such employment in Melbourne and Sidney, both in the private business establishments and Government workshops.

"In the building trades, in all the Australian colonies, labor has been in great demand for the past year and a half. The hours of labor in these trades are 8 hours per day.

"Laborers get per day from $1.50 to $1.75, carpenters and joiners $2.50, masons the same, slaters $3, plasterers $2.75, plumbers and gas-fitters $2.50. Workers in brass and copper get from $2 to $3 per day, and superior hands in that line are not plentiful. Painters and glaziers get from $2.50 to $2 75 per day, and cabinetmakers earn from $10 to $20 per week, according to their varied skill, they being chiefly paid by piece-work. Brushmakers have not as yet a very large field, and they work on the piece system, earning all the way from $10 to $20 per week, according to their abilities.

"Coach building is one of the rising industries. Railway cars are built in the Government shops and in private establishments, and this will cause and insure a great amount of work of that description. Coachsmiths earn from $15 to $20, wheelers from $15 to $25 per week, coach-body makers and painters about the same, and trimmers from $10 to $15 per week."

Railway Building for 1883.

The *Railway Age* publishes a table exhibiting by States the number of miles of track laid in the first three months of the present year. The total (on 49 roads) is 766 miles. New York leads with 114 miles, Arkansas is second with 91 miles, and Pennsylvania third with 73 miles. The weather has, up to April 1st, been unfavorable for track-laying. The *Age* says:

"Considering the drawbacks mentioned, this shows remarkable activity and indicates that the aggregate of new mileage for the year will be much larger than has generally been anticipated. Last winter, it will be remembered, was extraordinarily mild, allowing work to be prosecuted without difficulty, and up to April 1 about 1,200 miles of new track had been laid. This, however, was only about one-tenth of the total mileage laid during the year, and even at this rate, without making any allowance for the impediment of severe weather, the mileage for 1883 will reach nearly 8,000 miles. But that a severe winter and late spring do greatly retard railway building is proved by the fact that in 1881, after a very cold winter, less than 602 miles of new track were reported for the first quarter, while the aggregate for the entire year was no less than 9,358 miles. At the same rate of increase compared with the first quarter, the total for 1883 will be nearly 12,000 miles.'"

Starting in Business.

We frequently find large establishments loth to speak of their prosperity, says the *Stationer and Printer*, simply because some one may be tempted, by the glowing account, to make a similar venture, and, as the firm magnanimously asserts, it dislikes to see the young man entrapped and make a failure, arguing from the point that ninety-nine out of every hundred men that go into business fail.

There are several considerations that ought to be weighed carefully before people branch out in business on their own account. Has one the adequate cash capital for a beginning? Has he influential friends in the line of trade he has selected? And what is his reputation in regard to ordinary business honesty, capability, etc.? These points should be well attended to. Men who seem best able to judge, affirm that nearly half of the failures arise nowadays either through ignorance or carelessness of calculating the cost of doing business, or sailing too large a ship with too little ballast.

The following circular has been sent out by S. V. Benet, Brig.-Gen., Chief of Ordnance, Washington, D. C.:

"Referring to the circular from this office of January 19, 1883, enclosing a programme of tests submitted by the American Society of Civil Engineers, I have now the honor to inform you that, Congress having failed to appropriate money for the purpose, it will be impossible for me to pay the freight charges on the material sent to Watertown Arsenal for test. I will, however, be glad to make tests, if the material is sent there, free of cost."

The utilization of what were formerly considered waste products, is now carried to the extent of deriving a profit from hundreds of things that were formerly got out of the way in the easiest manner, and at considerable expense. An important consideration for any manufacturer is whether something is not being wasted that might be utilized, as the passing of a few such items to the other side of the account may make a material difference in the profits of manufacture. In the science of saving in this way American manufacturers are, generally speaking, a long way behind European manufacturers.

There seems to be no end to the uses to which paper is to be put, the latest notable one being to the making of pulleys which are said to have the requisite strength with only 25 per cent., the weight of iron pulleys. It is also claimed that belts do not readily slip on these pulleys, and hence may be run much slacker than on iron.

A Western oil company advertises dynamic tallow. Probably the next thing in order will be energetic butter.

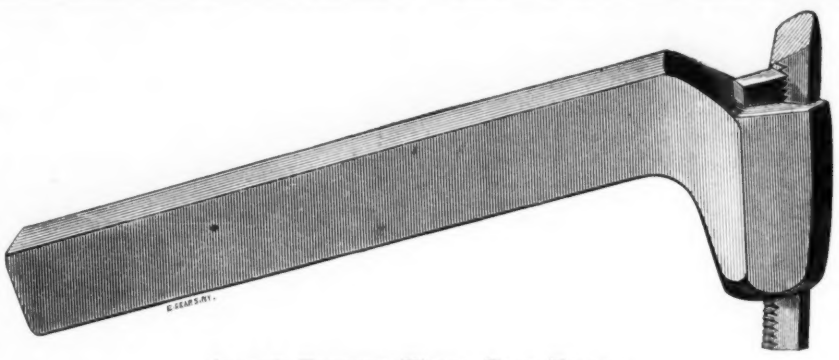
Allen's Toothed Wedge Tool-Holder.

The engraving presented herewith represents a tool-holder and cutting tool made by John F. Allen, 137th street and College avenue, New York. It consists of a shank of cast steel of the shape here shown. A hole is cast in the end for the reception of a cutter of round or square steel, with teeth cut upon one side or corner, as shown. A wedge of steel having teeth upon one edge to correspond with those upon the cutter is inserted into the hole with the cutter, and a light blow or two with a hammer secures the cutter in place. The teeth are swaged or rolled in the steel of which the cutter is made, so that all extra work in preparing the cutters is avoided. These cutters are made either of Mushet's special tool steel (which requires no tempering, being naturally hard enough for cutting all ordinary materials), or of any other desired brand of steel.

The object of this tool-holder is to use the steel as it comes from the manufacturers, without requiring it to pass through the injurious treatment that it receives while undergoing the process of forging in the hands of non-professional tool-dressers. It also saves the large quantity of steel wasted in forming the body of the tool, and the latter always remains of the same length. When once adopted, these tool-holders can be used for years, and the first cost is quickly covered by saving in time and material.

By using these holders the proprietor of a shop can well afford to use none but the very best quality of tool steel, which will enable the workmen to run their machines at a more advantageous rate of speed, and the tools cut more freely at a less expenditure of power.

These tools are made both right and left-handed, or straight as may be desired. When necessary, a special device is furnished with these tools for application to a grindstone, which acts as a gauge for holding the tool for grinding the cutting edge at any angle adopted. These holders are made in numbers from 0 up to 7, including sizes from $\frac{7}{16}'' \times \frac{7}{8}''$ up to $1\frac{3}{4}'' \times 2\frac{1}{4}''$ shanks. All sized cutters are furnished in quantities to suit users.

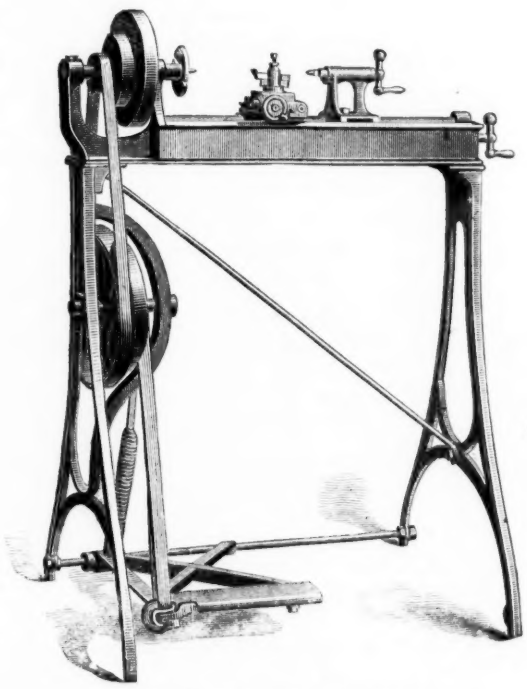


ALLEN'S TOOTHED WEDGE TOOL HOLDER.

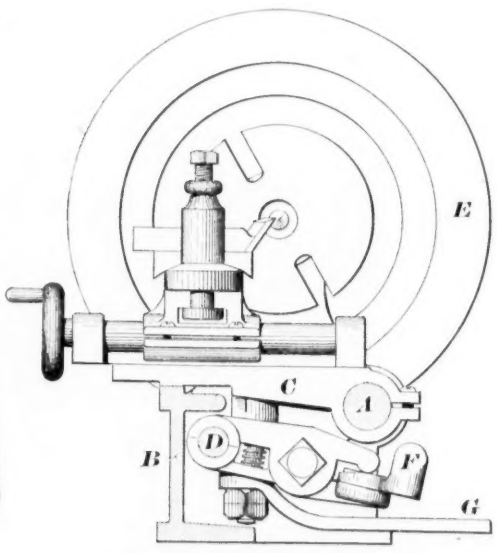
New Foot and Bench Lathes.

The foot lathe shown in the accompanying engraving was designed for the use of amateurs, students and apprentices, being made at a moderate cost, so as to be within the reach of all. The bed is of original design. By aid of the detailed engraving the reader will understand that the bed is composed of a single casting, shown in section at *B*. Instead of the regular planed V to guide the slide rest, a compressed steel bar *A* is used.

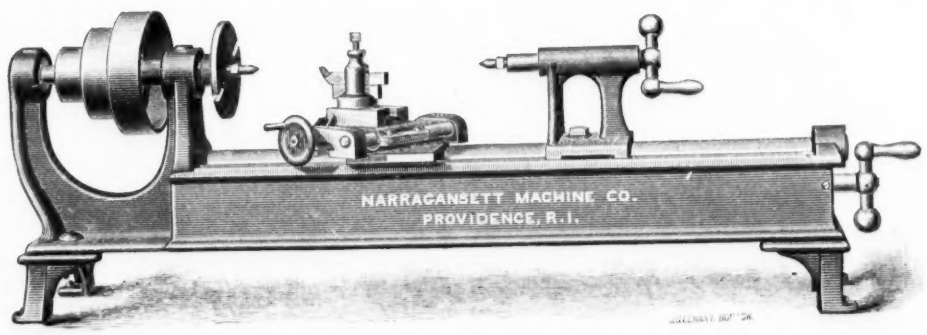
This construction cheapens the production of the lathe, and the form is claimed to be more durable than the regular V slides. Furthermore, the head stock, tail stock and slide rest are easily aligned with each other, and the slide rest can be moved the entire length of the bed.



FOOT LATHE FOR AMATEURS.



CROSS SECTION THROUGH BED.



BENCH LATHE FOR AMATEURS.

The slide rest can be quickly adjusted to face or bore at any desired angle. The carriage *C*, is readily attached to and detached from the feed screw *D*, by moving the lever *F*. The lever *G*, is used to secure or release the slide rest. By using a cone *E*, of large diameter, with a heavy rim, a balance wheel is secured upon the spindle, so that a steady motion of the work is obtained, which tends to prevent chattering.

The large pulley under the lathe is also balanced, so that unsteady motions and vibrations are altogether avoided. The driving motion has no dead centers, and will therefore start in all positions.

It does not require a steady, continuous movement of the foot while the lathe is running, as is necessary with the crank motion. With the driving motion upon this lathe all force applied to the treadle is utilized in compelling a direct forward rotary movement of the spindle. A pressure of the foot cannot possibly produce a backward movement of the spindle. The speed and power can be quickly adjusted by simple adjustments.

The power motion is very simple in its construction, consisting of a clutch which engages the pulley when the treadle is pressed downward. When the pressure is released the clutch returns and the wheel continues to rotate, the treadle being raised by a spring, as shown. The strokes may be long or short, quick or slow, at the will of the operator. A down pressure may be given and the foot allowed to remain upon the treadle without affecting the movement of the lathe, thus avoiding the necessity of raising and lowering the foot with every revolution of the wheel. Thus the lightest, most delicate and rapid work may be readily accomplished upon this lathe. The slide rest may be instantly removed, and a T rest substituted by the manipulation of a single lever.

The bench lathe, represented by the lower engraving, is made in the same manner as the foot lathe, but of larger proportions. It is intended to be driven by belt power from a countershaft. It will swing 8″ over the bed, $4\frac{1}{2}''$ over the carriage and will admit 18″ between the centers.

The spindle is hollow, having a hole sufficiently large to admit a rod $\frac{5}{16}''$ in diameter. It has tapered bearings constructed to take up wear. The centers have tapered fits, the dead center being discharged when the spindle is drawn in to its extreme position. The cross-slide has a travel of $2\frac{1}{2}''$.

Both of the lathes here shown are made by the Narragansett Machine Company, 23 Butler Exchange, Providence, R. I.

LETTERS FROM PRACTICAL MEN.

Why Iron Chills.

Editor American Machinist:

For chilling cast iron, different pieces require different treatment, but there is one essential point to be borne in mind: that is, the chill should be covered as quickly as possible. It is impossible to do this too quickly, providing the surrounding parts of the mould will stand it. The hotter and more liquid the iron, the deeper and smoother the chilled surface will be.

The process of chilling iron involves a chemical change in the part chilled. That part contains carbon in a combined form, while the parts of the casting that are not chilled contain carbon in two forms, graphite uncombined, and combined carbon in a less degree than the chilled parts.

Cold blast iron contains a larger per cent. of carbon than hot blast iron, and when liquid cold blast iron comes in contact with a chilling surface, the sudden lowering of temperature produces the chemical change which results in what is called a chill. The more liquid the iron, the deeper and more complete the process of converting the uncombined into combined carbon. When this change is made, so far as my observation goes, it is permanent. Even remelting does not undo the transformation.

A number of years ago there were made in the shop where I worked several large castings that were chilled from 1″ to 2″ deep. Some of these castings were condemned for imperfections. They were made from the best of iron—"Richmond" and "Saulsbury"—and the foreman concluded to put the condemned castings into locomotive driving-wheels. They were broken up and cast, and every wheel broke like an icicle when being pressed on the axle.

The castings I speak of were for safes, and one was taken from the sand while red hot and subjected to the cooling effect of a stream of water. This was done to demonstrate that, in case of a stream of water being played upon them at a fire, there would be no danger. When this one mentioned was cooled by means of the water, it was broken up like a piece of ice; in fact, a laborer with hob-nailed shoes literally granulated portions of it beneath his feet. This showed the chemical change going on to the end of the cooling process.

Now then, cold blast iron is the strongest of irons, yet it contains combined carbon in a greater degree than hot blast iron, which proves that, to a certain extent, its presence increases the tenacity, and beyond that it decreases the strength of the metal.

FOUNDRYMAN.

Engine-Lathe Catalogues.

Editor American Machinist:

Oberlin Smith's call for uniformity in machine tools is not likely to be met very soon. Uniformity is very desirable in many cases, but it is hard to get. Individual opinion will assert it self in the matter of holes and slots in planer platens, pitch and form of gear teeth, taper of centers, etc.

The great difficulty is to obtain the necessary information.

A good way out of the difficulty would be opened if makers could be induced to give a fuller description in their catalogues and circulars of their tools. Some catalogues are quite expensive in quality of paper and general make-up, and yet very unsatisfactory in the essential part—minute description of goods. It is curious to note the scarcity of figures. About the only items given by makers of lathes are the live spindle bearing (often only the front one), the swing over bed and over carriage, the length of bed and distance between centers, and the width of the belt. These few dimensions (often many of these are not given) are accompanied by the stereotyped eulogies that mean nothing. These, with what little can be gained from the accompanying cut or photograph, constitute about all the information that is to be had from catalogues and circulars. Many neglect to state the countershaft speed.

There are many points about a lathe, a knowledge of which would be beneficial to the buyer. The following are some of the points which a shop-owner would like to know about a medium-sized lathe:

Swing over bed; swing over carriage; height of centers from floor; length of bed; distance between centers; weight; size of pulleys and cone on countershaft; speed of lathe forward and backing; distance between cones for correct working of belt; size and taper of centers; dimension of bearings and kind of metal; dimensions of cone; diameter and length of tail spindle; working length of tail spindle; amount of set-over for taper turning; pitch and diameter of spindle screw; pitch and diameter of lead screw; largest size of tool steel admitted by tool-

post; amount of adjustment of tool-post up and down; length of cross-feed; pitch of cross-feed screw; feed pitches.

These items have been selected chiefly with reference to range and adjustability. While their setting forth would not directly produce uniformity in manufacture, it would enable a shop-owner to select tools to match what he already has, and thus preserve uniformity in the shop, and indirectly it would show a manufacturer the likes and dislikes of his design. It would do away with considerable cut-and-try in setting and speeding up.

When durability, accuracy and strength are considered, the above list of items would be largely increased; but these have more theory mixed up with them than the average user is likely to trouble himself about. What would benefit him is to know where he can get a machine that does not require the shop to be refitted especially for it in order to get reasonable work out of it; that won't stand a foot higher nor six inches lower than the rest of the tools in the shop; what speeds he can run it at to suit his work, and whether he can use his present size of tool steel.

One thing could be added to Mr. Smith's standard list that would be a great convenience to small shops in odd screw cutting, that is, the change gears. Make them of the same pitch and form of teeth, and the same size hole for arbor, so gears for one lathe can be used on another.

There are many details that are hard of access after the machine is up, and which the buyer cannot ascertain without much trouble, but all of which the manufacturer knows. How often is the internal construction of the apron seen after the lathe leaves the manufacturer? Or even the dimensions of the live spindle? These are important items in the way of durability and strength which are at present quite hard to obtain, but whose description would take little if any more room than the usual gush of "ample bearings," "excellent workmanship," etc., and would be far more serviceable in selling a good tool.

John O. Traide.

Weight on Balanced Slide Valves.

Editor American Machinist:

In your issue of April 14, in which the rule for estimating the weight on slide valves is criticised, I think the area of the back of the valve has been substituted for the area of the valve-seat covered by the valve (inclusive of area of ports), the two being materially different—the first always in excess of the latter.

If we take a plain slide valve of a certain size—say 4″×6″, measured at outer line of contact with seat—covering all the ports and at rest, with steam at 40 pounds above atmospheric pressure in the valve-chest, then the pressure on the valve-seat from that valve is undoubtedly 960 pounds, without any reference to the size of the ports or the thickness of the lips of the valve, provided the ports are open to the air. To make this plain, suppose the valve removed, the ports closed, and steam of 40 pounds pressure admitted. The valve-seat would then, with all other surface in the chest, sustain a pressure of 40 pounds per square inch. Now replace the valve and open the ports. This pressure on the valve-seat will then be transmitted to the seat through the valve, the valve receiving all the pressure that was formerly on the seat within the outer lines of the valve. It is true that the total pressure on the valve is greater in proportion as the surface of the back is larger than the area covered; but this excess is not carried to the seat, being balanced by opposite pressure and sustained by the valve itself.

While the valve is in motion and exhaust steam passing through it, this pressure is diminished inversely as the freedom of exhaust, or back pressure on the piston, is lessened. The sliding of this valve, if seat and valve are in order and well lubricated, should not require more than 100 pounds pressure applied in direction of motion. If the valve represented in your engraving was reduced by an area equal to the areas of the steam chambers under it, which can easily be done and yet leave surface enough, I think it would move as easily with the reduced area as with the full area and steam chambers, as the effect, claimed and admitted, of these chambers, with live steam in them, is to reduce the area of the valve, and consequently the pressure on it, by this amount. The fact of the reduction of pressure by the presence of these steam chambers is a proof of the rule I have used for the pressure on the valve. With a valve pressure of 408 pounds, as given, and a chamber or counter pressure of 402 pounds, we should certainly expect this valve to leak, as a stability of only 6 pounds would hardly be sufficient to keep it on its seat against the pressure of the exhaust and other causes which tend to lift it.

T. B. L.

Columbia, S. C.

Balanced Slide Valve Construction.

Editor American Machinist:

Having designed several engines, both with single and double-slide valves, I cannot see how Mr. McGregor is gaining anything with his valve.

First, let us take the common locomotive

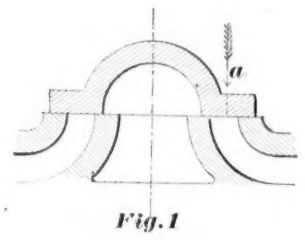


Fig. 1

slide valve, Fig. 1, which is known to be very much unbalanced; next, let us take two such valves, and plane them off at *a*, and attach them to one valve stem on a double

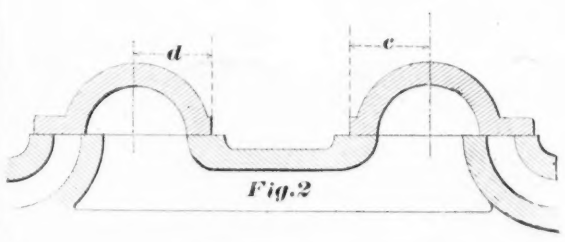


Fig. 2

valve seat, as shown in Fig. 2. It will be seen at a glance that we get a greater unbalanced portion in this arrangement (Fig. 2) than in Fig. 1, to the extent of portion $d+c$; the only thing that tends to relieve the downward pressure is the exhaust, which should be very little. Then, suppose we

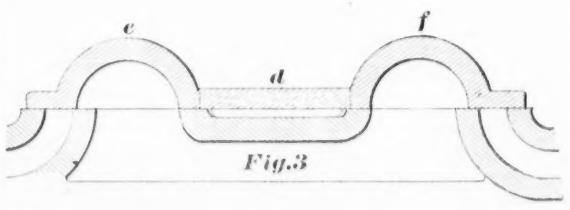


Fig. 3

add a plate *d*, Fig. 3, to this same valve, having a *cavity* below it. Suppose we let steam under this plate (at the same pressure that is on top of it); then, that portion of the plate which has steam under it only will be balanced. Thus it will be seen that the plate *d*, does not help, balance, or relieve the valves *e* and *f*, but in reality adds the weight of the plate *d*, to the load on the valves.

Again, take an end view of the valve,

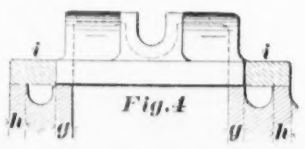


Fig. 4

Fig. 4, with section through the steam port. In the slide valve as it is generally made, the end bearings are as narrow as possible, only enough to keep a steam joint, as shown at *g*. Now, if we add more end bearing at *i*, *i* (in dotted lines), having a pocket below, this, with steam at the same pressure as above, will balance the pressure that is on the portion directly over it and no more. The portion which is over *h*, *h*, is an extra piece, with pressure on top, but none below, to relieve or balance it, which adds a little more to the load on the valves.

I can see, judging from the illustration (April 14th), that the model used in Mr. McGregor's experiments, not having a moving piston in it, or having an exhaust—steam working into the cylinder (from leaks or otherwise), would balance that portion over the ports; but if the steam were exhausted in the same manner as in the working engine, then the slide valve shown in the model would work harder.

Bert Baldwin.

Steam Pistons—Varieties of Packing.

By Charles A. Hague.

The varieties of piston packing are nearly as numerous as the styles of engines. Under the head of "steam packing" may be classed all these devices in which steam is admitted inside the rings at each stroke for the purpose of forcing them outward.

One of the commonest forms of packing is composed of two rings, edge to edge, next to the cylinder surface, and directly inside these is one ring equal in width to both the others Inside this inner broad ring are steel springs distributed around this circle, pressing the whole outward. This arrangement makes a very good packing when well proportioned, although it is often constructed in a manner which makes it an instrument of abuse to the cylinder, and many specimens may be found in which the springs (?) are stiff enough to support hundreds of pounds. This form of packing is often used in horizontal engines with no spring in the lower half of the circle, but in their stead are set screws.

The idea is to let the piston ride on the rings, which are made broad for that purpose, and the set screws are employed to adjust the piston to the center of the cylinder; the upper half-circle being provided with springs to give the necessary elasticity.

There are several patented piston packings composed of one or more rings cut into several pieces, the joints at the cut being guarded by suitable "keepers," and each section having its own spring. The object of this is to provide a flexible elastic ring, capable of self-adjustment, so as to readily conform to the cylinder bore.

It has always seemed to the writer that these multi-sectional packing rings were exposed to more risk of leakage by reason of their many joints than would compensate for any extra advantage they might possess in the way of fitting the bore. In a cylinder well made, of good iron, and bored as truly as it can be bored with modern tools, there is no very great danger of steam escaping by the piston of ordinary construction, provided it is well put together. These different types of sectional packing have many friends and advocates.

Then there are packing rings specially adapted to soft cylinders, composed of brass or cast-iron rings plugged or faced with strips of soft metal, and held out to place by small coiled springs of brass or German silver wire.

One of the simplest forms of piston and one used with success is a solid cast-iron block with a thickness equal to a third of its diameter, fitting easily in the cylinder, and in the edge of which are turned two or more grooves. Into these grooves are sprung packing rings, which have been formed a little too large for the cylinder, and then cut and put in place. The effort of the rings to recover their original diameter holds them snugly against the bore. The cuts in both rings are at the bottom of cylinder (horizontal engine), and as the piston proper rides on the bottom, it is depended upon to prevent steam from reaching the cuts in the rings. When we consider the shortness of the periods of time during which the steam is endeavoring to force its way in each direction, the dependence upon such a piston does not seem unreasonable, and also when it is considered that any enlargement of the cavity through which a fluid seeks to escape tends to check the flow, the terrors of leakage in these simple pistons are very materially reduced. The philosophy of the solid piston, furnished with grooves in its edge, but no packing, is, that the grooves are in effect a sudden enlargement of the annular space between piston and bore through which the steam is forcing its way. When the groove is reached, the volume is so quickly enlarged that the pressure is reduced and the flow retarded. This retardation, once commenced, is continued by the next groove the steam encounters, so that if the flow was always in one direction, half a dozen grooves would reduce the leakage to nearly nothing; but when the direction of flow, far from being continuous in one direction is reversed many times per minute, it would be surprising if the steam penetrated to half the thickness of the piston. A plain, solid water piston furnished with such grooves will, when started with the pump perfectly empty and dry, and even with the piston $\frac{1}{32}$″ slack in a 5″ pump, create sufficient vacuum to raise water fifteen or twenty feet. Experiments have been made at different times with the view of ascertaining the efficacy of this grooved solid piston, one of the most interesting of which is as follows: A solid piston without grooves was fitted into a cylinder with a closed bottom. A note was made of the time this piston required to fall to the bottom of the cylinder (upright) by its own weight, when the air had no means of escape except the leakage between the cylinder and piston. A groove was then turned in the piston and sufficient weight added to compensate for the metal removed. The effect was that the descent of the piston occupied a much longer time, and the addition of more grooves ultimately retarded the descent in the proportion of one to twelve—that is, the plain piston had allowed twelve times the quantity of air to escape in the same time that the grooved piston did.

The inference from the above is, not that such pistons can be employed in operating steam engines, but that the wear of the metal is about the only thing to be provided for.

The methods of securing the piston to its rod are also numerous. In some practice the piston is shrunk on the rod. The rod is turned a trifle larger than the hole in the piston, the piston heated, the rod dropped in, and when cold the whole is finished up together. In other cases the hole is bored tapering, the rod accurately fitted and ground in, and after being driven tight home, is either riveted or held by a nut on the rod end. Very large pistons are sometimes keyed to the rod by means of half-keys driven in from opposite directions, the draft being on the face of the keys coming in contact with each other, thereby affording keyways without taper, both in the piston and rod.

Another way employed for large pistons is to form a taper on the end of the rod, with the largest end of the taper at the end of the rod. The smallest end of the taper is a little larger than the working part of the rod, so that a screw being cut just above the taper, a nut may be slipped over the working part of the rod from the cross-head end. The rod is put through the piston from end to end, the taper fitting into the piston and preventing it from going off the end of the rod; the nut being slipped over the rod and screwed hard down on the piston, renders all secure. Still another method, for small pistons, however, is to form a screw on the rod and a corresponding one in the piston, and thus screw the two parts together. This plan has some objections, the chief of which is the difficulty of removing the rod when desired.

But whatever the style of piston, or how-

ever the rod may be secured therein, the principal requirements are, a truly round cylinder and piston, the rod situated accurately in the center, and the axis of the rod coincident at all times with the axis of the cylinder.

Arithmetic and Metrology.

By John W. Nystrom.

The discordance among nations in adopting a uniform system of weights, measures and coins, is caused by the base of our decimal arithmetic not being well suited for that purpose. In the shop and market it is desired to divide the units into binary fractions, which cannot be accommodated by the base 10 without cumbrous decimal fractions, and the ordinary vulgar fractions are difficult to use in arithmetical calculations.

The best system of metrology yet devised for decimal arithmetics is the French Metric System, which has been adopted by most civilized nations, but not by the most practical nations, namely, those who speak the English language. The practical difficulty with the metric system is due to the arithmetic base 10, not admitting binary and trinary divisions without fractions, and that system is therefore inapplicable to the division of the circle and time, and can consequently not be used in navigation, geography and astronomy. These incurable defects of the metric system can never make it stable, but its abolishment is a mere question of time.

With the steady and unabated progress of science, our descendants will not be contented with an incomplete system of metrology, but will, most probably, devise a system that will accommodate the shop and market as well as geography and astronomy The metric system is, however, far superior to the cumbrous English metrology, and there is yet a chance for the English-speaking nations to devise and adopt a system of metrology that would be acceptable all over the world in defiance of the foothold taken by the metric system. Those who are thoroughly conversant with the subject seem to agree that the number 12 is the best suited as base for metrology, for the reason that it can be divided by 2, 3, 4 and 6 without leaving fractions, which is of great importance for the shop and the market, and particularly so for mental calculations.

A committee of the English Parliament, of which Lord Overston was chairman, appointed for investigating the feasibility of adopting the metric system, reported that 12 as a base of metrology would be much better for the shop and the market than the metric system.

The number 12 has always been a favorite base in metrology, particularly so by the ancients, and is yet advocated for that purpose by self thinkers in different countries.

The old French foot was divided into 12 inches, the inch into 12 lines and the line into 12 points. The dozen is a well-known base adopted all over the world; 12 dozen is a gross and 12 gross is a great-gross. We have 12 months in the year, 12 hours in a day, 12 signs in the zodiac, 12 musical notes in an octave. The old Roman metrology was based on 12, like the English foot, and the Troy pound.

A writer in the Edinburgh *Review*, regrets that the philosophers of France, when engaged in making so radical a change in measures and standards of the nation, did not attempt to reform the popular arithmetic.

This writer advocated very strongly the adoption of 12 as a base, not only for metrology but also for arithmetic, and he hoped that the wisdom of the English-speaking nations would soon come up to the level of this species of reform, namely, to adopt the number 12 as the base for all measurements. But such important improvements are not thought of in the ordinary course of human affairs.

The Latin name for "twelve" is *duodeni*, and any system of metrology or arithmetic which is based on twelve is called *duodenal system*.

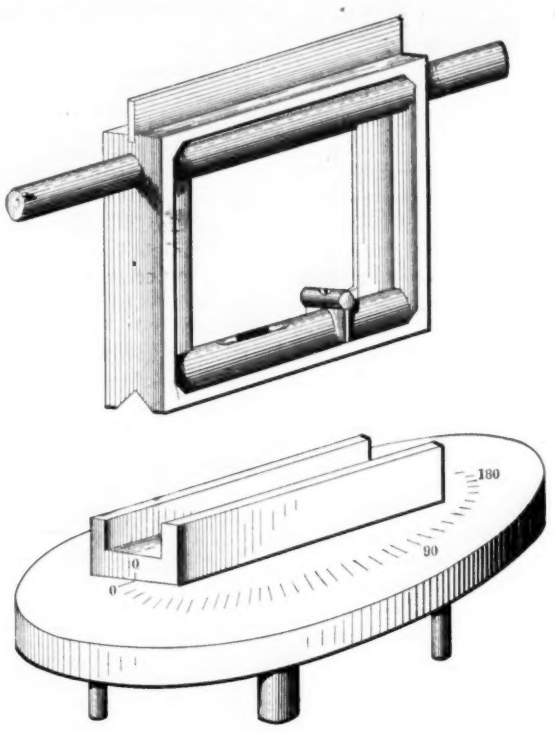
A full description of duodenal systems of metrology and arithmetic will be found in "Nystrom's Elements of Mechanics."

The duodenal metrology, with the present English units, should be introduced first, and worked with decimal arithmetic until its utility is well understood, after which it would become very easy to introduce the duodenal arithmetic.

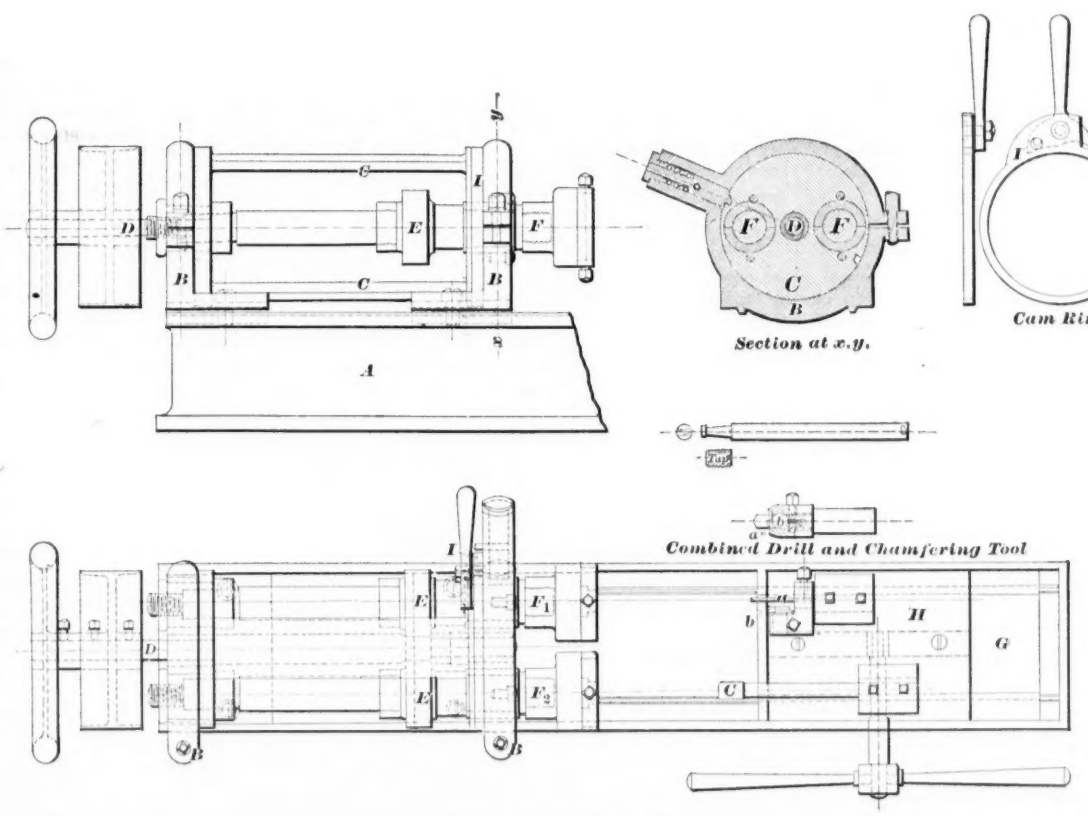
The duodenal arithmetic is as much better than decimal arithmetic as the latter is better than the Roman notation. The duodenal system has all the advantages and none of the disadvantages of the decimal system.

The English-speaking nations are behind the other civilized nations in two particular things, namely, in metrology and phonetic orthography. The removal of these two serious defects would save at least one-half of the time, labor and expense now consumed in education. The saving would amount to a great many millions of dollars annually in this country.

Our present systems of metrology and orthography are great burdens upon children to learn; in fact, they can never learn them so as to be remembered, whilst the study of natural systems would be entertaining and never forgotten.



Leveling and Surveying Instrument.



Nut Finishing Machine.

Nut Finishing Machine.

By R. C. Fay.

The engraving represents a nut finishing machine built for special work, which accomplishes the purpose of drilling, tapping, squaring up and chamfering nuts in a very satisfactory manner It may be of service to those who have work of this kind to do. With this machine a man will finish $\frac{13}{16}$" cast iron nuts at the rate of 1200 per day. The following brief description, with the engraving, will explain the construction and operation of the machine:

Fastened to the bed *A*, are two rings, *B*, *B*, which support the frame *C*, in the center of which is the driving shaft *D*. This shaft has a pinion which meshes into gears, *E*, *E*, thus driving the parallel spindles, *F*, *F*, with the chucks for holding the nuts to be finished. The opposite end of the lathe bed *A*, supports a short bed-piece *G*, into which is dovetailed the carriage *H*. This carriage supports the drill *a*, for drilling, the round tool *b*, for squaring up the face and chamfering, and the tap *c*. The tap is short, as shown, and is run entirely through the nut, the shank being long enough to contain ten nuts.

The detail drawings of these tools, I think, will explain themselves.

In operation, a nut is placed in the back spindle chuck F_1, the tools brought forward and the nut drilled and chamfered as shown; then by means of loose cam ring and handle *I*, the spindles are reversed; then a nut is placed in chuck F_2, and the tools brought forward, when the nut in chuck F_1, will be tapped and nut in chuck F_2, will be drilled and chamfered simultaneously.

Leveling and Surveying Instrument.

The object of the inventor of the instrument represented herewith is to provide a convenient substitute for the various tools used by a mechanic in erecting machinery; an instrument for the use of bridge builders, masons, and in fact for all purposes where a surveying instrument is only occasionally required. The instrument consists of a rectangular frame, in the lower section of which are adjusted a longitudinal and transverse spirit level, while the top part contains a telescope at right angles with the sides and parallel to the top and bottom of the frame.

In one of the sides is inserted a narrow blade, which makes of the bottom and that side a try-square. If desirable, the instrument may be provided with a foot similar to those in use with ordinary surveying instrument.

The use of this instrument for getting levels, intersections, horizontal, vertical and angular adjustments, &c., will be readily understood.

For erecting lines of shafting, the V-shaped groove on the bottom is provided. By placing this groove on a length of shafting and sighting some distant point, the succeeding lengths may be made to approach that point, or recede from it, in correct alignment.

In the upper part of the engraving is shown the instrument proper, while the lower part represents the foot provided when required. This foot, as will be seen, consists of a shoe centered in a graduated table, the latter being provided with adjusting screws. This machine is the invention of Rudolph Peter, P. O. box 40, Hartford, Conn.

In our last week's issue we gave the sizes of the new Niles Tool Works three office rooms from a rough estimate. We learn that the actual measurement is as follows: Front office, 15 feet wide and 28 feet long; middle office for book-keepers, 18 feet square; private office, 15 feet wide and 28 feet long.

Manufactures.

The citizens of Loveland, O., are very anxious that a manufactory of some kind should be started there, and are raising subscriptions for that purpose.

The lawsuit between the Bessemer Steel Association, which purchased of Jacob Reese, of Pittsburgh, the right to his basic process, and Mr. Reese, who claims a right to resell to others, has caused the Harrison Steel Company to wait further developments before it builds its immense plant in Southern Illinois.

The Ferracute Machine Co. Bridgeton, N J., manufacturers of coin-makers' machinery and other sheet-metal tools, have issued a new catalogue of 64 pages fully illustrated. The machines are described rather better than in the average machinery catalogue, but the engravings are not first class. A profusely gilt cover does not add to the neatness of the pamphlet, which is very well printed.

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NEW YORK, APRIL 28, 1883.

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Mechanical and Commercial Problems in the Machine Business.

If buyers of machinery sometimes have cause to complain of the quality of what they buy, or what they can find to buy, it not less often occurs that the manufacturer is tempted to an inquiry into the propriety of building something better than he can sell. The complaint is usually on the assumption that the mechanical problem is the only one involved, while in point of fact, with the present knowledge of the mechanic arts, the attaining to any reasonable degree of excellence is only a question of cost—something that has to be settled by commercial rather than by mechanical considerations. The manufacturer must make what will sell rather than what he would like to make; he must furnish the supply, which must be preceded by the demand. More than one manufacturer has experienced the difficulty of leading with the supply—putting the mechanical before the commercial consideration—and although such efforts are useful in educating the demand up to looking for something better, there is generally too much uncertainty about the result to make them popular—that is, to make them pay. It is not only discouraging, but frequently disastrous, to the manufacturer to find himself trying to force a demand for something better than any one is looking for; especially discouraging when he knows it is no better than is needed. It would probably be true to say that the manufacturer in nearly every instance would willingly improve the quality of his product, without much reference to how good it may already be, if he could see his way clear to getting paid for doing so. Nothing is more natural than that a mechanic should find his satisfaction in making machinery that is right without reference to the cost of doing so, and the propensity to do so is sometimes too strong to be resisted.

Steam engines, it is sometimes said, of a given power are made by one builder for a price less than the cost of the material that would be put into the same power by another builder, but it is by no means certain that it is the choice of either to build poor engines. On the contrary, it is probable that both would like to build good ones. The building of the cheap engine represents to a certain extent the necessity of the manufacturer. The buyer demands something cheap, gets it, and in the end the builder gets the blame for making the only thing he could sell—something which mechanically he disliked, but which commercially satisfied him, or with which he was obliged to satisfy himself. The manufacturer is quite as likely to find himself building something better than he can sell as the buyer is to find himself looking after and willing to pay for something better than he can find. Experience slowly leads the buyer to consider other things than the price, and the manufacturer is usually anxious to take advantage of this to further the interests of both by making and selling better machines and machinery, but the educating process is naturally somewhat slow.

The difference in price is a present feature, while advantages to be gained are prospective. Those who build and sell good machinery are never so well satisfied as in dealing with those who know all about the advantages of quality. Mutual knowledge in this respect will not materially change the commercial, but it gives the mechanical aspect proper prominence.

There are always buyers who thoroughly appreciate the difference between weight or dimensions and quality, and nothing is more natural than that they should complain of the difficulty of buying what is up to their standard. When there are enough of their way of thinking to indicate anything like a demand, they find no difficulty in supplying themselves.

The quality of machinery made and sold in any locality is not generally representative of the skill or ability of the manufacturers. It represents more nearly the extent to which the buyer and user appreciate what is good; the relative prominence they give to mechanical and commercial considerations when buying.

It need not be implied that there is not in machinery such a thing as good enough. Machinery is bought for its utility, and when the cost of more and better material and work will not return an equivalent in future use, the limit is reached. If the mechanical consideration was the only one the manufacturer might be trusted to exceed the limit of the best economy in this respect. The commercial consideration may, however, always be trusted to keep him some distance in the opposite direction, at least until a good deal of missionary work is done among buyers.

The True Remedy for the Free Pass Evil.

Something over a year ago, the roads leading west from Chicago entered into an agreement to issue no passes to influence business. This agreement the Chicago & Alton now alleges has not been lived up to, and the Alton, in consequence, has given formal notice of withdrawal therefrom on April 15. It also gives sixty days' notice of withdrawal from the Chicago-St. Louis pool, on the ground that other members of the pool have issued passes to influence business.—*Railway Review.*

We have never yet heard of a railroad pool agreeing not to issue passes to influence legislation or to influence newspaper notices. Members of legislatures travel at their pleasure, without paying a cent for railroad fare, and when a bill comes up forbidding the issuance of free passes except to railroad employes, as was the case at Albany a short time ago, they take good care to defeat the measure. Newspapers that accept free passes are not at liberty to criticise this petty bribery system, and deem it policy to keep quiet upon the subject. We repeat what we have previously advanced as the only effectual remedy. If the railroad companies want to abolish the free pass system, let them give to the press, for publication, the name of every individual asking for and receiving a free pass, with the reason for its being granted. If there is any honest reason why any individual should travel upon a free pass, he need not be afraid to let the public know the fact. There are both legislators and newspaper men who will not accept such gratuities, well knowing what their acceptance implies. The public should know who are under obligations to railroad companies. When passengers are obliged to pay a high rate of fare in order to make up for losses in carrying a horde of dead-heads, they are in justice entitled to know for whose transportation they are involuntarily contributing.

Rapid Ocean Transit.

Whether the *Meteor*, about which so much has been said, will do anything towards solving the problem of rapid ocean transit, cannot as yet be predicted. In any event, while a line of passenger boats to Liverpool upon which the time of passage was materially shortened might be of service, the economical advantages of rapid transit are probably entirely overestimated. Rapid transit means costly transit, and except for passenger service, and that only to a limited extent on account of the cost, is probably not called for. A large proportion of international traffic is to ocean transit what the carrying of freight is to the general business of a railroad, and in this it has long since been demonstrated that a moderate speed is the most economical. The problems involved in rapid transit by steamship and by railroad, while quite different in many respects, are yet enough alike to warrant the comparison, whatever of difference there is being chiefly in favor of the railroad. The fact that steamships absorb so much of the carrying between foreign ports is owing quite as much to the reasonable certainty of the time occupied as to the dispatch, so that if it were possible to reduce, by one half, the time between New York and Liverpool it is probable that a line of steamers running at such speeds would have considerable difficulty in competing with slower lines in which the expenses were materially less.

It is the opinion of those presumably competent to judge that the profits of existing steamship lines would be increased by a considerable reduction of present speed, one prominent Clyde shipbuilder asserting that a speed of eight instead of twelve miles an hour would represent better economy on long voyages, or that six and one-half voyages instead of nine in the year would be far more profitable to the owners. In the end it may be found that it is one thing to build a steamship to cross the Atlantic in four or five days, and quite another thing to demonstrate that it will pay to build such a steamship. The mechanical feature of the case is, however, as yet an interesting one.

Chances for Russian Machinery Orders.

Industry, a manufacturers' journal published in London, reproduces our editorial from issue of March 17th, entitled "American Machinery for Russia," with U. S. Consul VanRiper's letter, and invites the attention of English manufacturers to the efforts being made by that Consul at Moscow to introduce American machinery into Russia more extensively than ever before. Since that editorial was published some of the largest manufacturers of cotton machinery in this country have taken active steps to secure orders for fitting up new cotton mills about to start in Russia. At least one of them proposes to send a direct representative to Russia prepared to take orders for building mills and fitting them up with machinery and appliances complete for manufacturing. It is quite unlikely that English and German machinery manufacturers will continue to monopolize the Russian markets as they have done heretofore. The Russians are ready and willing to welcome Yankee enterprise. No adverse prejudice exists to hamper the introduction of American machinery. None but plain business problems are to be met. The chances for Russian trade are fully as much in favor of our machine tools and machinery for special manufacturers as for cotton machinery.

Literary Notes.

MECHANICAL DRAWING SELF-TAUGHT. Comprising Instructions in the Selection and Preparation of Drawing Instruments, Elementary Instruction in Practical Mechanical Drawing, together with Examples in Simple Geometry and Elementary Mechanism, including Screw Threads, Gear Wheels, Mechanical Motions, Engines and Boilers. By Joshua Rose, M. E. Illustrated by three hundred and thirty engravings. Price, $4. Published by Henry Carey Baird & Co., 810 Walnut street, Philadelphia, Pa.

We quote from the author's preface as follows: "The object of this book is to enable the beginner to learn to make simple mechanical drawings without the aid of an instructor, and to create an interest in the subject by giving examples such as the machinist meets with in his every-day workshop practice. The plan of representing in many examples the pencil lines, and numbering the order in which they are marked, the author believes to possess great advantages for the learner, since it is the producing of the pencil lines that really proves the study, the inking in being merely a curtailed repetition of the penciling. Similarly, when the drawing of a piece, such, for example, as a fully-developed screw thread, is shown fully developed from end to end, even though the pencil lines were all shown, yet the process of construction will be less clear than if the process of development be shown gradually along the drawing. * * * The author believes that in learning mechanical drawing without the aid of an instructor, the chief difficulty is overcome when the learner has become sufficiently familiar with the instruments to be enabled to use them without hesitation or difficulty, and it is to attain this end that the chapter on plotting mechanical motion and the succeeding examples have been introduced; these forming studies that are easily followed by the beginner, while sufficiently interesting to afford to the student pleasure as well as profit."

AMERICAN FOUNDRY PRACTICE, by Thomas D. West, composed mainly of his articles that have appeared in the columns of the AMERICAN MACHINIST during the last two years is having a large sale among the practical foundry-men of this country, besides which over 500 copies of the book have been sold to go to England, by the publishers, John Wiley & Sons. The book has been very favorably received by the press and the public.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(157) W. S. S., Montgomery, Ala., asks: 1. Is it true that a hydraulic cylinder is more likely to burst if air gets into it? *A.*—We think not, at the same pressure and temperature. 2. What would be a safe hydraulic pressure for a cast-iron cylinder, the bore being 15″ and the metal being 8″? *A.*—Assuming the cohesive strength of the iron to be 16,000 lbs. per square inch, the ultimate strength, according to Barlow, would be a little more than 8,000 lbs. per square inch. Probably the cylinder would be reasonably safe at a pressure of 4,000 lbs. 3. Would four wrought-iron rods, each 4″ in diameter, be sufficient to resist the pressure of a ram of that size (15″) under a pressure of 4,000 lbs. per square inch? *A.*—The rods are rather small. If not larger than 4″ it would be better to make them of steel. 4. Would you advise the use of a steam pump, or a pump driven by a belt? *A.*—Whichever it is most convenient to use.

(158) E. B., Groton, N. Y., writes: "We have an engine 10¾″x24″, running 125 revolutions per minute. The steam ports are small on the valve face, being but ¾″ by 6″, but larger in towards the cylinder. The eccentric is keyed fast to the shaft. The stroke of the valve is variable from 2¼″ to 3¼″ by means of a rock shaft. I propose to put on a false seat with steam ports 15-16″ x6″; exhaust port, 1⅞″x6″; steam lap, 13-16″; exhaust lap, ⅛″; bridges, 9-16″; travel of valve, 3¼″, these proportions being all I have room for in the steam chest. I also propose to use a 3″ steam pipe and governor. Saving of steam is no particular object, but we want to get a good deal of work from the engine. The clearance of piston I shall make 3-16″. The exhaust port will close 2½″ before the end of the stroke. 1. Will this give too much compression? *A.*—The clearance in the ports will probably be sufficient to keep the compression reasonably low. 2. Will there be any difficulty in getting rid of the exhaust? *A.*—The ports are small, and there will be some back pressure. By analyzing the valve motion you will see that the exhaust port will be partially closed while the piston is traveling the fastest, which is a bad feature. It will help the matter some to make the valve without any inside lap. It would be still better to increase the width of bridges 1-16″, reduce the steam lap of valve ⅛″, and reduce the travel so that the valve will lack ⅛″ of fully opening the steam port, and key the eccentric over again. This will give a freer exhaust, and keep within the limits of the steam chest. If you make as you propose, leave no inside lap on the valve. The steam pipe and governor proposed are right, and the change you indicate will be an improvement over the present small ports.

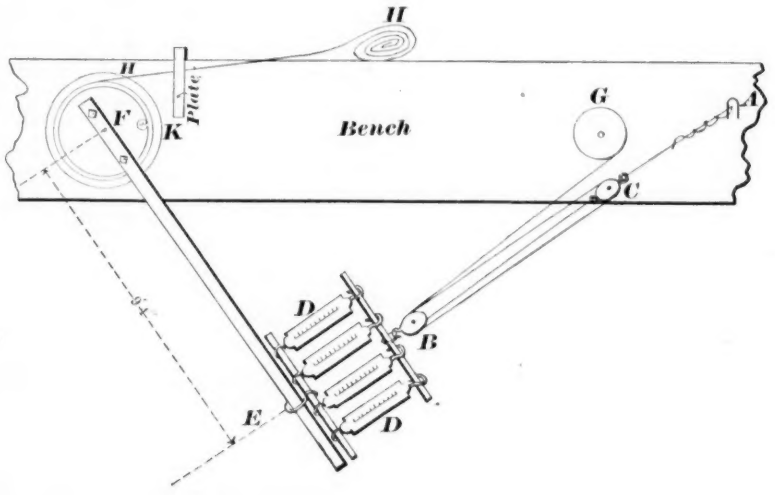
(159) Wire Mill, ——, ——, writes: To determine the power necessary to draw wire, "A" rigs the following apparatus: *F* is a rod block 28″ diameter; *H*, *A* is a wire rod in coil, No. 5, before it passes through plate, and reduced to No. 7 by passing through hole in plate. The end is fastened to block by means of a set screw, *K*. *F*, *E* is a lever 9 ft. 4″ from center of fulcrum, *F*, to center of load, *E*, and the radius of block being 14″, the length of long arm is 8 times that of the short arm. *D*, *D* are spring balances. *B*, *C* is block and tackle, employed to obtain a steady motion to start the lever, the block *C* being fastened to staple *A*, and the end of rope fastened to another wire block, *G*. The block *G* is then slowly turned until the wire rod is drawn through the plate, when the scales are examined and found to indicate 35, 36, 36 and 37, or a sum total of 144 pounds. "A," then says it takes 144 pounds to draw the rod through plate on that lever, the long arm of which being 8 times the length of short arm, the weight it would take at the surface of block where the rod is, would be 8×144=1152 pounds. The diameter of block is 28″, and the circumference 7 feet 4″, revolving at the speed of 50 revolutions per minute (which is the normal speed). This makes 366 feet 8″ per minute, multiplied by 1102 pounds=422400 foot pounds, which divided by 33000=12.8 horse power to draw rod to No. 7 on 28″ block running 50 revolutions per minute. "B," claims the calculation is incomplete because no account is taken of the distance that the rod is drawn through the plate, nor of the time in which it is drawn such distance. "A" replies that this is immaterial, as the 144 pounds are necessary to draw it through, no matter what speed or length. The queries are: Who is right, A or B? *A.*—We should say that A was right. Let B look at it in another way: Instead of a lever suppose a pulley of the same radius, or 18.666 feet diameter is used. It is evident that the tension of the belt would be the same as the pull on the lever; in other words, the constant resistance at the face of the pulley to be overcome is 144 lbs. and this must be overcome at a speed of 18.666×3.1416×50=2932.05 feet per minute; hence the power required would be, $\frac{2932.05\times144}{33000}=12.8$ horse power, as before. The question of velocity should be considered but once, but that should be at the point where the resistance is measured or computed. Where this is done, is simply a matter of convenience. It is probable that the resistance may vary slightly at different velocities, but how it will vary, or to what extent, can only be settled by experiment. 2. Is A's experiment right, regardless of B's claims, and will it give good results, assuming the appliances as shown to be in proper condition? *A.*—A's experiment appears to have been very well conducted indeed, and should give correct results. 3. Do you know of any tests to determine the power required to draw wire? *A.*—We do not know of the record of any tests of the kind.

For a strictly first-class automatic engine, from 10 to 60 horse-power, apply to the Straight Line Engine Co., Syracuse, N. Y; medium or high speed; perfect balance; finest parts and finest working joints; uniform speed at all ranges of power or steam pressure; the best material and workmanship in all vital parts; the most correct distribution of iron. Unexcelled in smooth running.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

Now ready for delivery, volume 5 of the AMERICAN MACHINIST, comprising the year 1882, (52 issues) complete with index, in substantial book form. Also a few remaining of volumes 3 and 4 comprising the years 1880 and 1881, can be sent anywhere by express. Price of each volume, $4.00; express charges to follow. AMERICAN MACHINIST Publishing Company, 96 Fulton street, New York City.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.



BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

James W. See, Consulting Engineer, Hamilton, O.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Machine designing and general engineering work, T. J. Winans, 54 M. & E. R. R. Av., Newark, N. J.

Currier & Snyder's Improved Upright Drill. Send for cut and price. Worcester, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

For sale, 25″ lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

H. E. Penney, manufacturer of Steel Spring Cushioned Helve Hammers. Photo and circular on application. Minneapolis, Minn.

New tool chest, price $10. See description in AM. MACHINIST, April 14th, or send for circular. Goodnow & Wightman, 176 Wash'ton st, Boston, Mass.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Boiler Scale.—Parties having fine specimens for sale or loan, for exhibition, address Jas. F. Hotchkiss, 84 John street, New York.

The Complete Practical Machinist, $2.50; the Pattern Maker's Assistant. $2.50; Mechanical Drawing Self-taught, $4.00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

A handsome monthly journal sent free to engineers and mechanics. Enclose twelve 6-cent stamps for year's postage and receive paper. Money Saver, 95 Liberty street, N. Y.

Wanted—Standard and Special Machinery catalogues for reference in making selections for customers. C. C. Hill, Mechanical Engineer, 144 La Salle street, Chicago, Ill.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

MANUFACTURES.

Williamsburg County, S. C., wants a cotton mill established within its limits.

J. J. Watrous, Cincinnati, has added machinists' supplies to his hardware trade.

George Richardson, Lowell, Mass., is about to erect a machine and bolt shop.

The Blakeney Foundry Works will erect at once a new foundry building in Springfield, Ohio.

The Cotton Factory Company, capital $50,000, will soon begin to erect a mill at Birmingham, Ala.

Forbes & Curtis, Bridgeport, Conn., have started night work again in manufacturing their die stocks.

Wilson & Stein, founders and machinists, Des Moines, Iowa, have moved into a new and larger shop.

John Breman & Co., Detroit, have bought a $2,000 lot in Battle Creek, Mich., for the erection of boiler shops.

The Jamestown, N. Y., Boiler Works will be in operation about May 1st. Its projectors are from Corry, Pa.

The Hooksett (Me.) Manufacturing Company will increase their plant by building a new cotton mill next summer.

The Humboldt Iron Works, Erie, Pa., are building Lafler's new brick machine, which, it is said, will make 40,000 bricks a day.

Capitalists from New York have been at Bloomington, Ill., several days, and have selected a site for the erection of extensive iron-works.

Daniel Kelly, of the late firm of Kelly & Ludwig, Philadelphia, has opened a commission machinery business at 49 North Seventh street, in that city.

The Whitney Arms Co., of Whitneyville, Conn., are preparing tools and fixtures for a foreign government to be used in the manufacture of small arms.

It is proposed to establish a new iron works in Cumberland, Md. The cheap ores of Virginia and the cheap coal of George's Creek, near by, are the attractions.

The Polytechnic Foundry, St. Louis, Mo., has been purchased by Wash & Wilcox. The capacity will be doubled. Architectural iron work is the specialty.

The Pound Manufacturing Company, of Lockport, N. Y., has closed a contract with the Panama Canal Company to dredge 10 miles of the canal at a cost of $1,000,000.

Sweetland & Co., manufacturers of the well-known Sweetland chuck, New Haven, Conn., will soon move into more commodious quarters to accommodate their increasing business.

The stockholders of the Union Iron and Steel Company, of Chicago, have agreed to the proposition to increase the capital stock to $3,000,000, of which $1,400,000 shall be preferred. This will enable the management to resume operations.

R. H. Brown & Co., of Westville, Conn., are preparing to put up a large factory for the making of bits, screw-drivers and specialities in machinists' small tools near the Winchester Repeating Arms Co., New Haven, Conn.

R. H. Brown & Co., Westville, Conn., are filling an order for the Mexican Government for fixtures and tools for the manufacture of firearms. They have recently added to their tools several drills, milling machines, &c., of the Pratt & Whitney Co.'s make.

Smith, Hill & Co., Quincy, Ill., manufacturers of milling machinery, have recently purchased a new building, to which they will remove their machine shops some time in July. This addition to the property will give them a full quarter block.

The Southington Cutlery Company, at Southington, Conn., have declared a dividend of 33 per cent. to the stockholders from the surplus accumulated, and voted to increase their capital stock to $300,000, and will add to its present business that of silver plating, etc.

The foundry of the Winsted Foundry and Machine Company of Winsted, Conn., was destroyed by fire March 3. They are now laying the foundation for a brick foundry, 73x40, one story to be completed by the 20th of April, which they are to fill with new machinery.

Citizens of Hubbard, O., have raised a bonus of $10,000 for the tin-plate mill talked of there for some time, and the proprietor of the enterprise, R. J. Hutchings, has left for England, where he expects to secure the additional capital of $50,000 necessary to build the works.

A new malleable iron foundry is to be built near the Junction, at Worcester, Mass., this season. One of the parties interested in the enterprise came from Sweden three years ago as a Government expert to study and report on iron-working in America.

The Lake Shore Tube Works is the name of a new manufacturing establishment about to be erected in Pittsburgh, Pa. The object of the company is the manufacture and sale of wrought-iron tubes and pipes. The new concern will be a rival of the National Tube Works, at McKeesport.

The United States Express Company's agent in Paterson, N. J., reports that his company is carrying more silk, raw and manufactured, to and fro, than for some months past. This should be a fair indication, for a greater part of the carriage, both ways, is in the hands of this company.—*Dry Goods Bulletin.*

Lattimore & Piggott, dealers in machinery, are filling a large order placed by Carlos Suarez for an engine and boiler, and a complete outfit of machinery for a planing mill, sash and door factory—seventeen machines altogether. The same order also calls for a saw mill, a corn-cob mill and several other machines. All of the machinery included in the order will be erected in Government works at San Luis Potosi, Mexico.

The Wharton Safety Railroad Switch Co., of Philadelphia, are gradually removing their works to Jenkintown, Pa., where the entire establishment is to be finally located. At the latter place about 150 men are employed, while more than 400 are employed in Philadelphia. It is said that the removal will effect a saving of 90 cents a ton in freight for the delivery of all material, and from $15,000 to $20,000 annually in taxes.

The mills at Lewiston, Me., are still troubled for water, being obliged to stop at two o'clock each day. Some of the mills in the State are unable to run any portion of the time, and nearly all of them are troubled more or less for want of water. There is an immense body of snow on the ground at the present time, but the severe cold weather prevents it from being any help to the streams. Some suffering and a general discouragement is noticeable among the operatives.—*Cotton, Wool and Iron.*

Robert W. Gardner, of Quincy, Ill, issues the following circular under date of March 29: "I beg leave to announce that the business owned by me and known as the Gardner Governor Works, has this day been incorporated under the laws of the State of Illinois, by the name and style of the Gardner Governor Company. This will effect no change in the management, which remains the same. The Gardner Governor Company will largely increase the present facilities for production of the perfected Gardner Governor, and have already commenced the construction of entire new works."

The Roanoke, Va., *Times* states that recent developments in Roanoke County show very large and extensive deposits of a very excellent iron ore conveniently located. It rather closely estimates that pig metal can be made at the following cost:

1¼ tons of coke	$3.13
2 tons of iron ore at $1.75	3.50
1 ton of limestone	60
Labor per ton of metal	75
Interests on investment	50
Incidentals	50
Total per ton	$8.98

Machinists' and Engineers' Supplies.

NEW YORK, April 12, 1883.

Business in supplies continues to move along quietly, with few incidents worthy of notice. Orders continue rather small, but there is a fairly satisfactory number of them.

The Deane Steam Pump Co, Holyoke, Mass., have opened a new office and salesrooms at 620 and 622 North Main street, corner Christy avenue, St. Louis, Mo.

The Pig Iron market presents no new features, and prices remain about the same as last reported. We quote Foundry, No. 1, at $23 to $23.50; Foundry, No. 2 X, $21 to $21.50; Grey Forge, $18 to $19. Foreign Iron continues in light demand. Wrought Iron Scrap is in moderate demand at $26, prime, selected from yard. Merchant Bar is dull at 2.2c. to 2.3c. for Common, and 2.4c. to 2.5c. for Refined from store. Copper is dull at 15⅞c. Banca Tin, 22c. Straits and Malacca, 21¾c. to 21⅞c. Billiton, 21⅛c. to 21¼c. Lead, 4.40c. to 4.50c. Antimony, Hallett's, 9¾c. to 9⅞c.; Cookson's, 10¾c. to 10⅞c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

A mechanical engineer, now superintendent, desires a position as draughtsman, superintendent or manager. Address, M., AMERICAN MACHINIST office.

Wanted—Situation as superintendent or engineer by a man of many years' experience, now filling similar position. Address, Superintendent, care AMERICAN MACHINIST.

Wanted—A superintendent for machine works in a Western city. Must be well up in all departments; a good draughtsman and designer; have good executive ability, and a thorough knowledge of automatic cut-off steam engines. Address, F, AMERICAN MACHINIST office.

Wanted—A young engineer; must be intelligent, prepossessing, good talker, and well up in all branches of steam engineering; to travel through the New England and Western States; salary or commission; one to two hundred dollars security required. Address P. O. Lock Box 1,738, Bridgeport, Conn.

Wanted—By one of the best established machinery and supply houses in New York City, a man as mechanical engineer and salesman. Must be a practical millwright and draughtsman, posted on steam engines and appliances, machine tools, &c. One lacking any of these qualifications will not answer. Address, with reference as to character, habits and qualification, X, care AMERICAN MACHINIST.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.

Wanted—Partner with capital for a valuable mechanical invention. Address "Inventor," care Am. Machinist.

For Sale Cheap—Machinists'. Foundry and Boiler Tools, now in use, with or without shop. John Cathcart, Waterloo, N. Y.

Wanted—A Hydraulic Press of from 50 to 100 tons' pressure; one that works quick for pressing small articles. Address Dexter Curtis, Madison, Wis.

For Sale—One of Burk's Watchman Time Detector, six station; only been used four months; cause for selling, no use for it. Price, $30. Address, Jno. C. Newell, New Haven, Conn. Box, 1024.

A large manufacturing corporation, exceptionally favored in its location at tide water, in successful operation for over forty years, is desirous of increasing its business by taking up specialties of established utility and merit, in either wood, iron or composition, light or heavy work. Correspondence solicited from parties interested. All communications treated confidentially. Address, A., care AM. MACHINIST.

NEW FOOT
LATHE.
Swing 8 x 18 inches, with improved foot power, Tool Carriage, Slide Rest, etc., **$30.** Power Bench Lathes, with or without Slide Rest. Send for Circular,
Narragansett Machine Co.,
Buler Exchan ge, Providence, R.I.

THE WHITE MACHINE CO.,
WATERBURY, CONN.
Double and Single Action
POWER PRESSES
Clock and Button Machinery, Special Automatic Machinery for Manipulation of Metals.
Drawings and Patterns furnished to Order.

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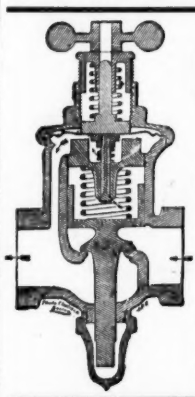
DESCRIPTIVE CATALOGUE, 100 PAGES, 1883, SENT FREE ON APPLICATION.
E. & F. N. SPON, 44 Murray St., N. Y.

FOR SALE.

We have the following second-hand Machinery for sale, viz.:
One Iron Planer, to plane 24 feet long, 62 in. x 62 in. square. It is powerfully geared, heavy and in good order.
One Planer to plane 15 ft. long 51" wide very good.
One Iron Planer, to plane 12 feet long, 36 in. x 32 in. in fair condition.
One Iron Planer, to plane 12 feet long, 30 in. x 30 in.
One Pit Lathe face plate 6 feet dia., with internal wheel full dia., external wheel 38 in. dia., quadruple geared, will turn 10 feet dia. and 22 in. face in pit, swing 60 in. over ways, 48 in. over carriage, 21 ft. 6 in. between centers. All complete.
One Engine Lathe, will take 14 feet between centers, and swing 53 in over ways, has hollow spindle, and is adapted for both turning and boring, with countershaft. Complete.
One Engine Lathe, will take in 11 feet, 6 inches between centers, swings 48 inches over shears, and 32 inches over carriage. It has internal gear, and cross-feed, with countershaft. All complete.
One Slotting Machine, 12 in. stroke, slots to the center of 46 in. Adjustable table and universal feed motion.
One Combined Power Punch and Shears, to punch ⅝ and ½, and shear ½ in. iron.
One Axle Lathe, Fitchburgh Machine Co.
One 13 in. Shaper, Lowell Machine Shop.
One No. 1 Brown & Sharp Screw Machine.
Two 4 in Spindle Drills.
One Pond's double Miller.
The George Place Machinery Co.,
121 CHAMBERS AND 103 READE STREETS, NEW YORK.



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Machinery and Supplies,
12 CORTLANDT ST., NEW YORK.
AGENTS FOR

The Waters
Perfect Governor.
Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

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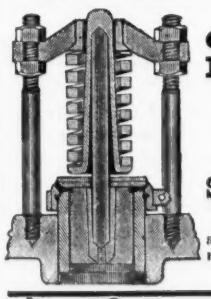

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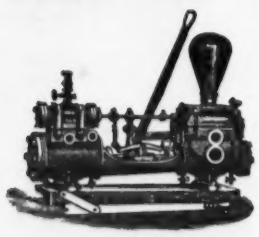

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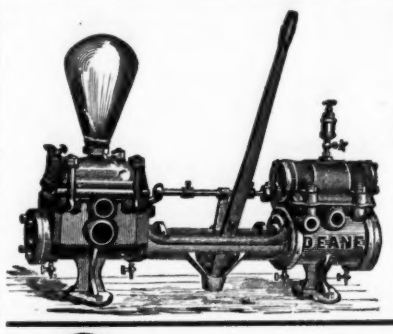

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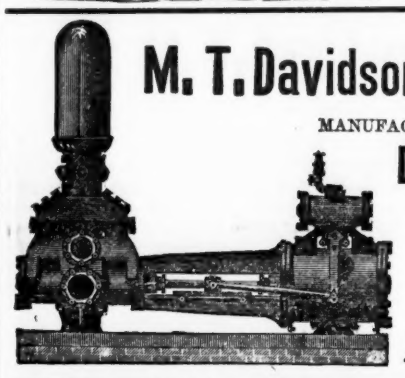

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Davidson Steam Pump Co.,
OFFICE & WORKS:
41 to 47 KEAP STREET, BROOKLYN, N. Y.
Warranted the Best Pump made for all Situations.
KELLY & LUDWIG, Agents,
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THE HERCULES TURBINE
Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.
—BUILT BY—
THE HOLYOKE MACHINE CO.
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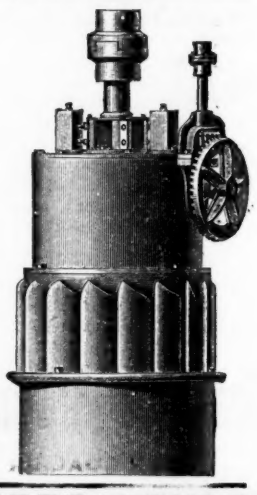
Send for Catalogue, Circulars and Price List to either of the above places.



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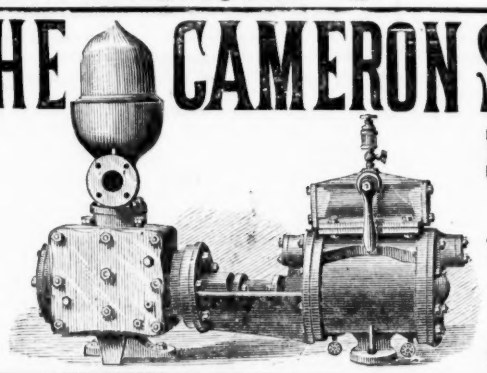

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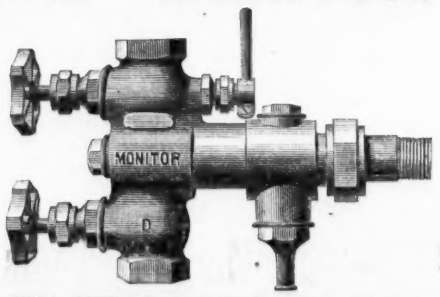

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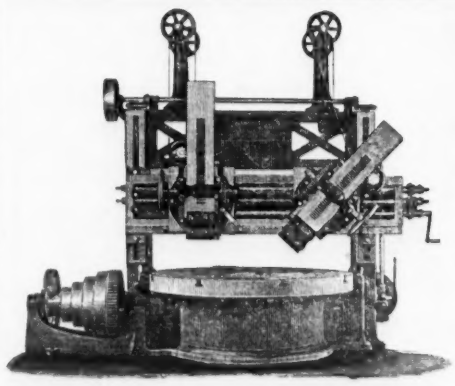

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THE CONSOLIDATED SAFETY VALVE CO., 111 Liberty St., New York,
Gentlemen:—The 5-inch Nickel-Seated Pop Safety Valves, which have been in use on our Mill boilers for about ten years, have given entire satisfaction. They have *never corroded* any, *never stick*, and always go off at the pressure at which they are set, and are now in as good condition as when new. We could not dispense with that style of valve and feel safe.
Yours respectfully, H. W. SAGE & CO.

Bay City, Mich., February 17th, 1882.
CONSOLIDATED SAFETY VALVE CO., 111 Liberty St., New York,
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Respectfully yours, EDDY, AVERY & EDDY.

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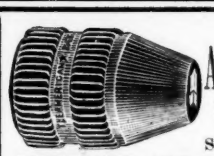

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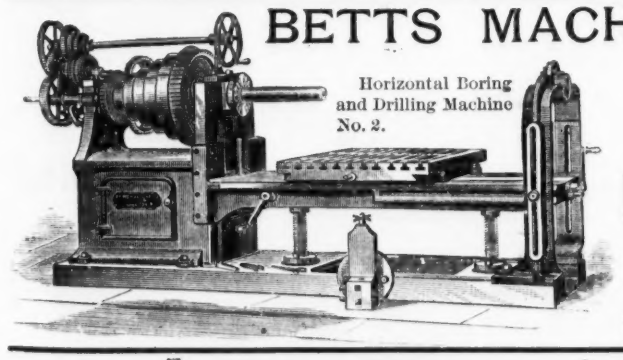

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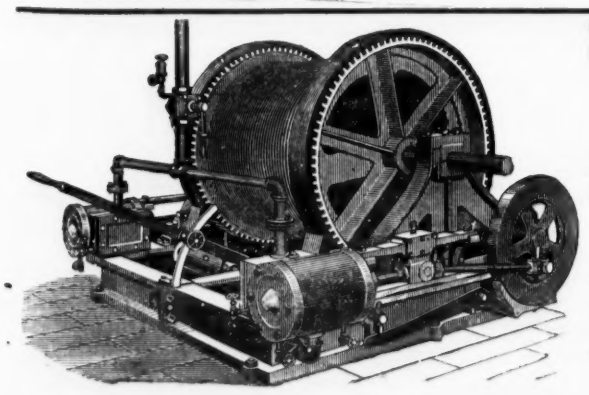

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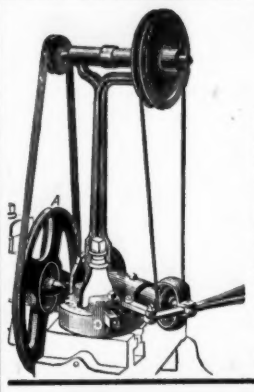

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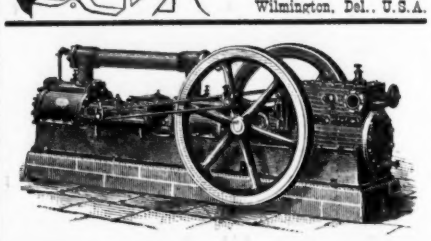

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With Steel Screws. Lathe Made and Hardened.

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" 9	1 3-8 "	1.10
" 10	1 1-2 "	1.10
" 11	1 3-4 "	1.25
" 12	2 "	1.40
" 13	2 1-4 "	1.60
" 14	2 1-2 "	1.60
" 15	3 "	1.80
" 16	3 1-2 "	2.00
" 17	4 "	2.30
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Full set, 19 Dogs, 26.35

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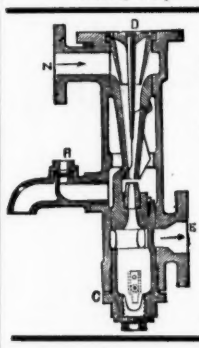

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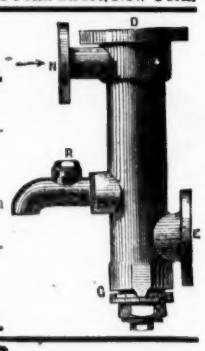

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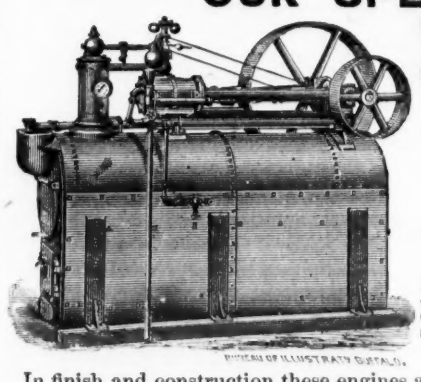

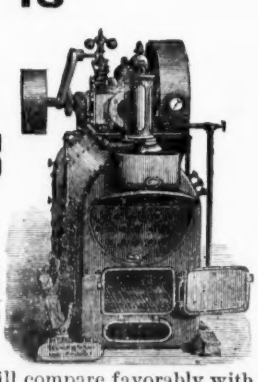

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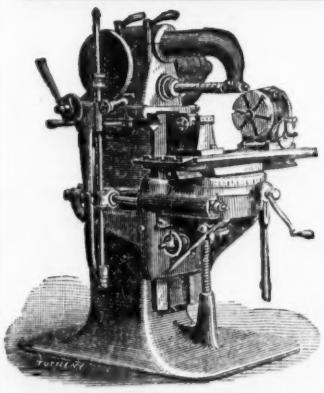

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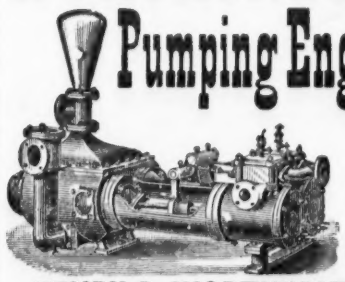

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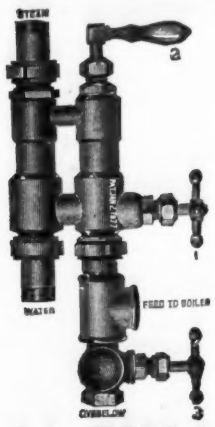

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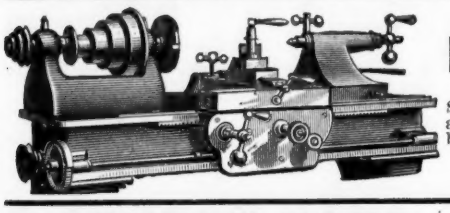

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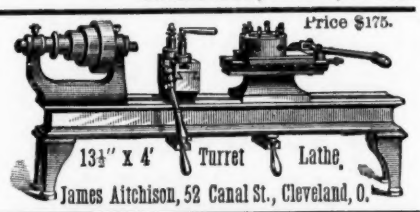

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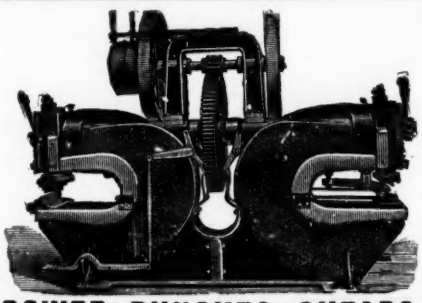

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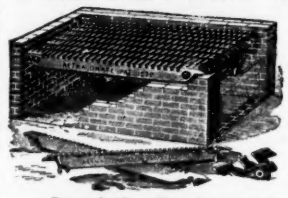

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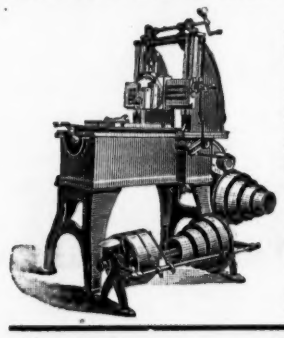

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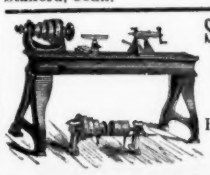

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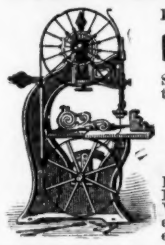

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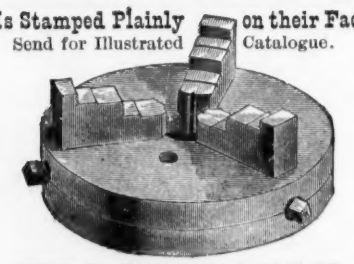

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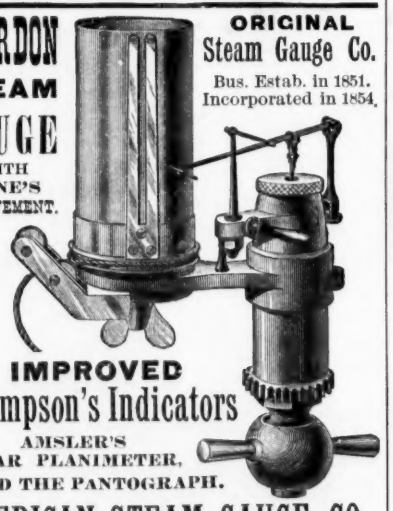

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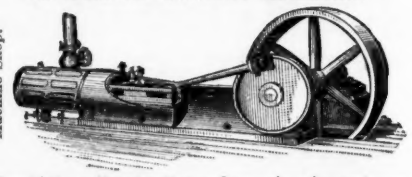

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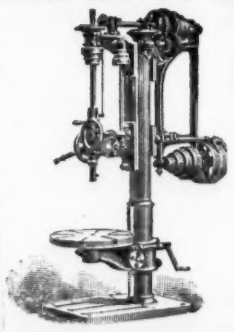

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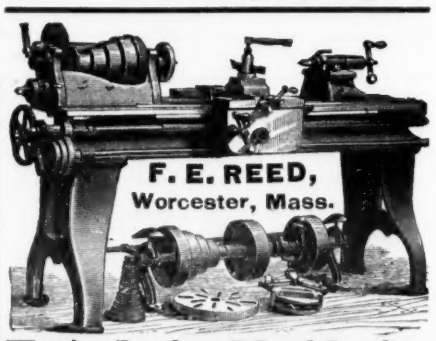

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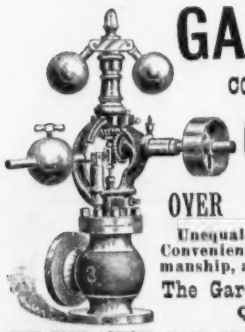

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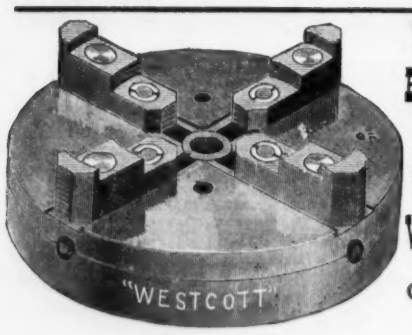

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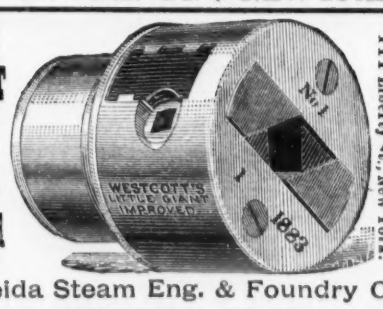

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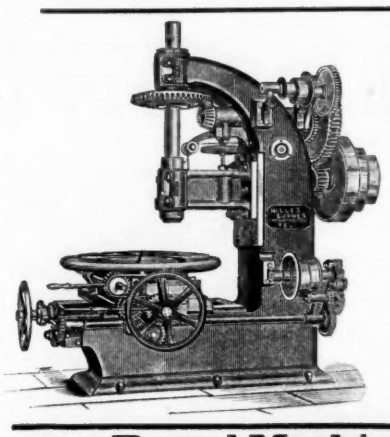

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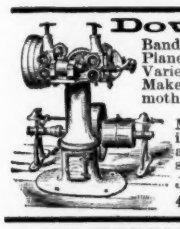

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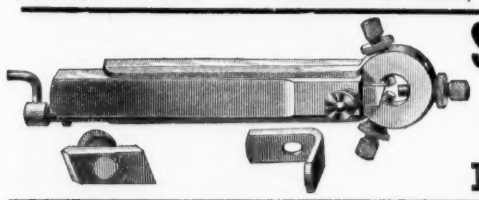

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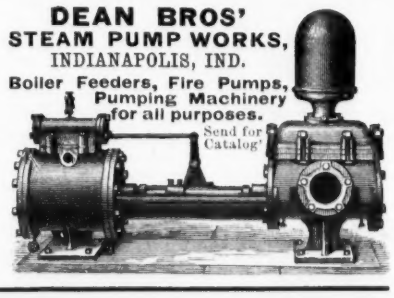

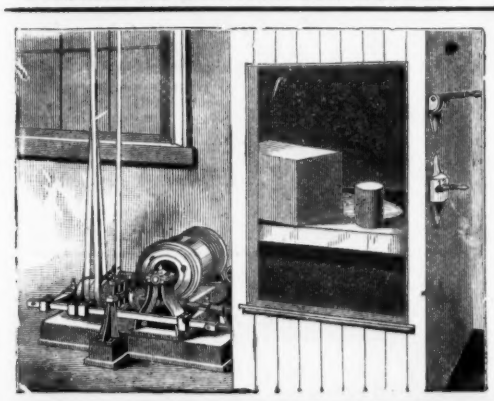

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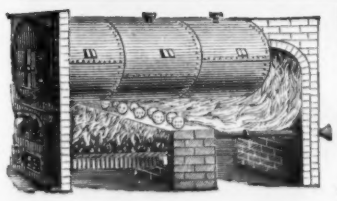

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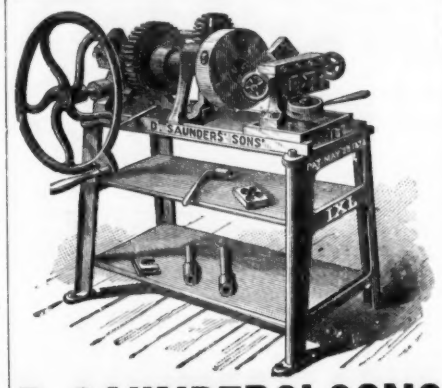

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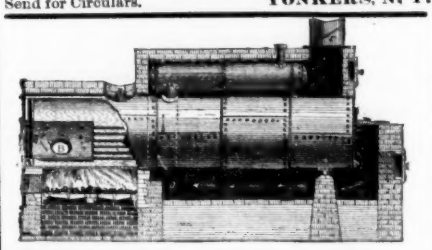

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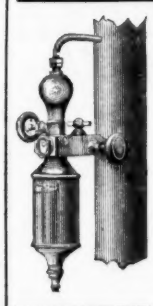

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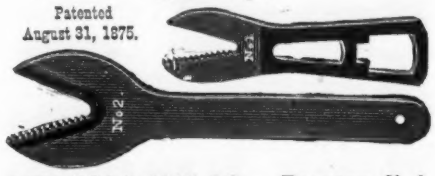

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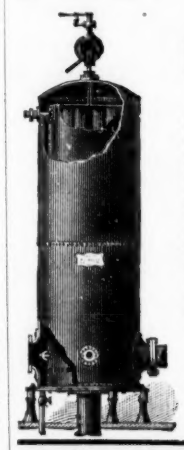

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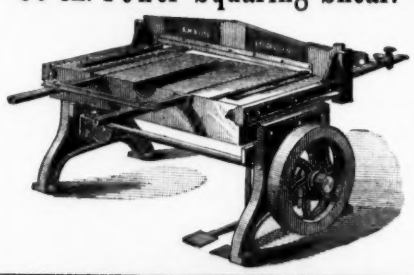

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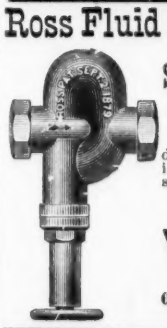

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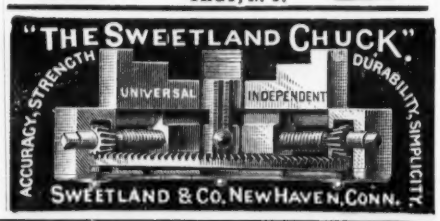

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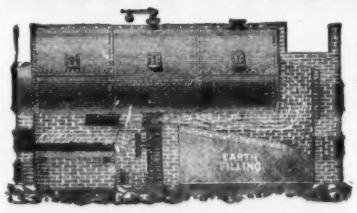

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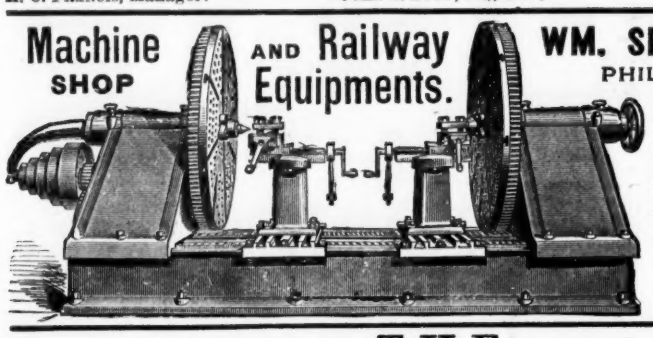

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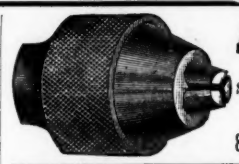

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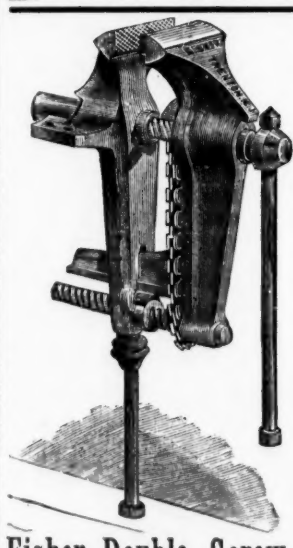

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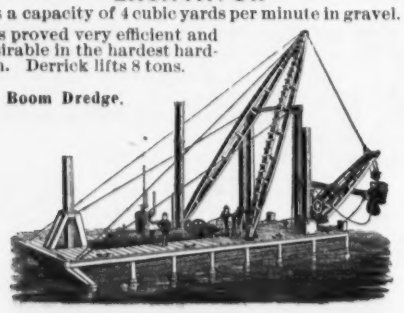

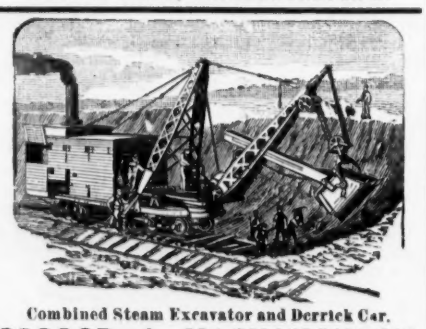

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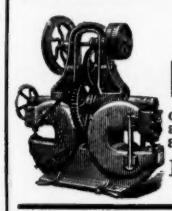

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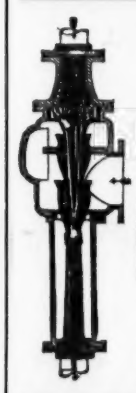

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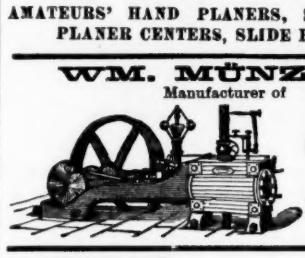

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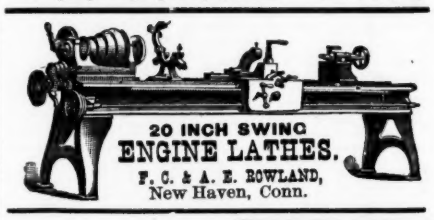

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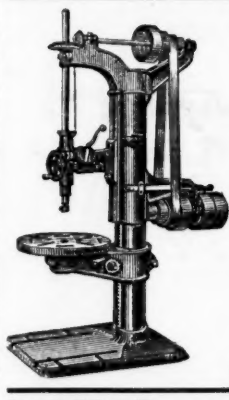

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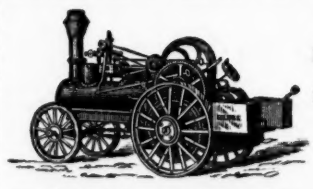

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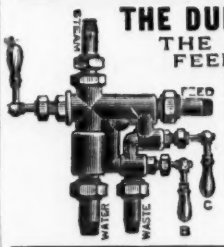

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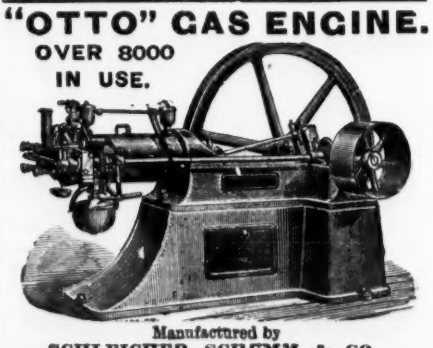

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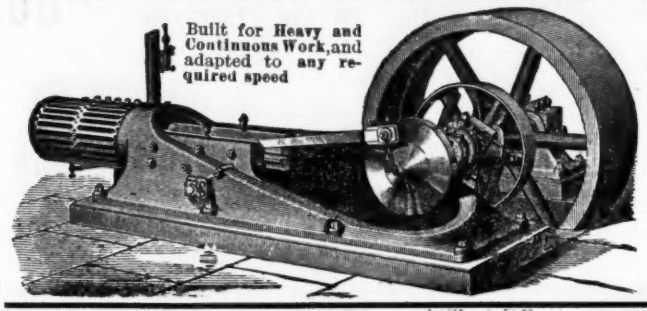

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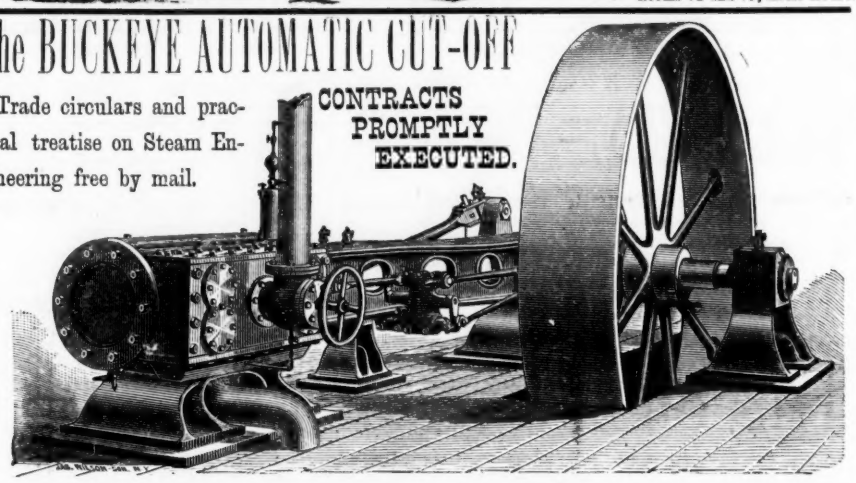

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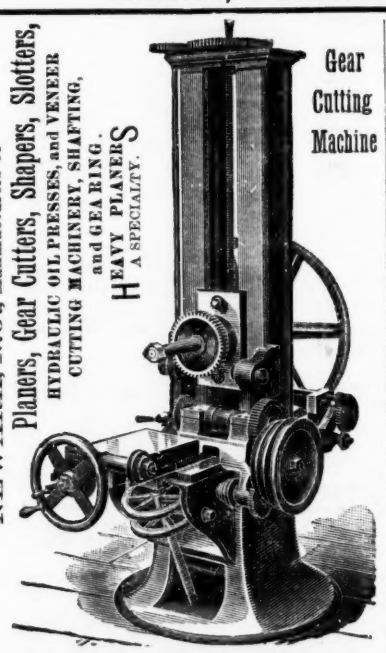

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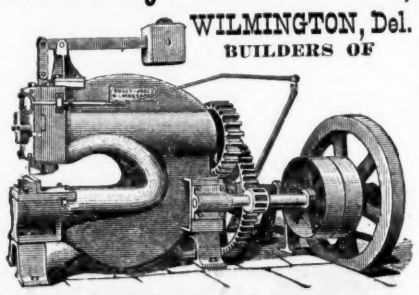

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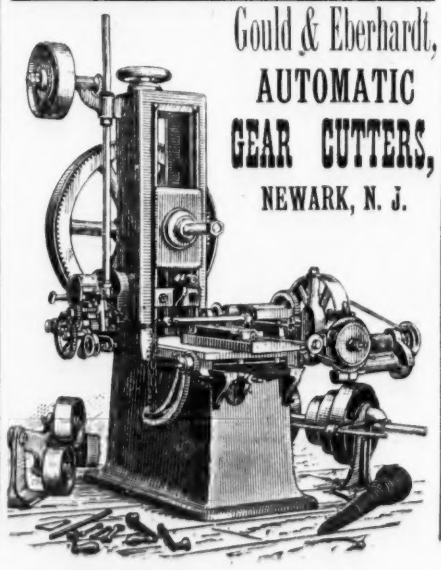

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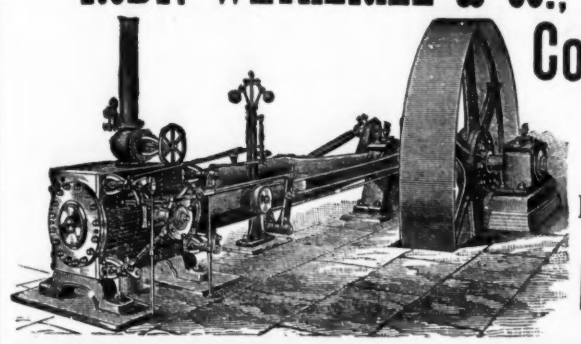

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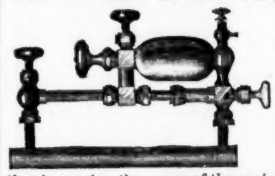

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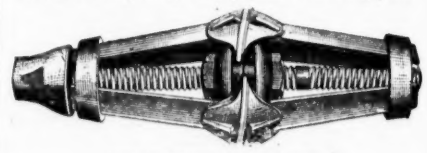

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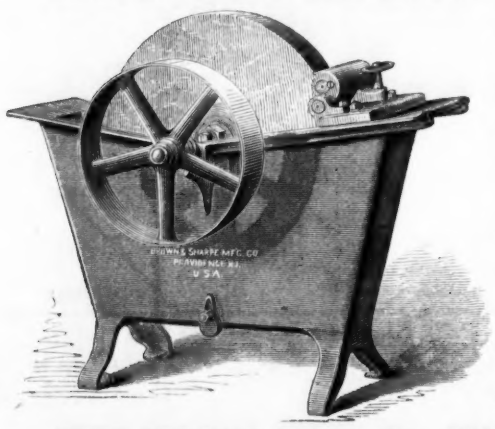

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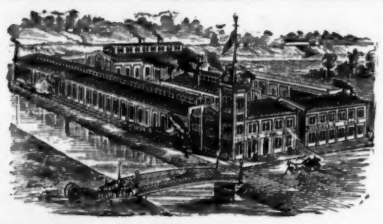

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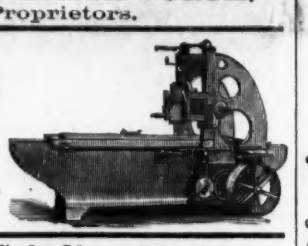

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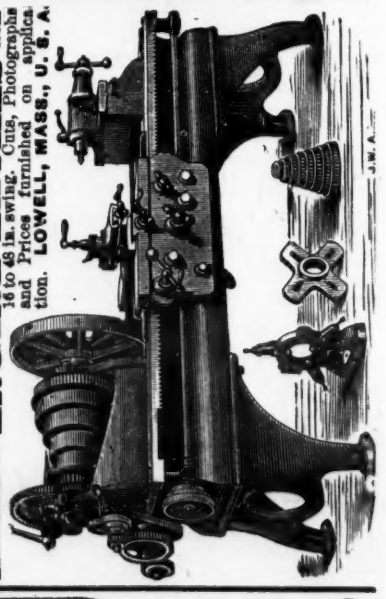

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